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Abey, A.E., Apparatus for deformation tests at intermediate strain rates—10^{-2} to 10^{-2} s^{-1}—and at high pressure, 3:1118 (UCRL-79012)

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ENERGY RESEARCH ABSTRACTS

COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 5889, 6894

PROCESSING

REFER ALSO TO CITATION(S) 5841, 6952

5770 (FE—2343-14-1) **Preliminary dependency analysis for program evaluation.** (Booz, Allen and Hamilton, Inc., Bethesda, Md. (USA). Booz, Allen Applied Research Div.). Mar 1977. Contract EX-76-C-01-2343. 32p. Dep. NTIS, PC A03/MF A01.

Based on a review of documentation relevant to the fossil energy technology development and acquisition process, a generic dependency chart was developed as a framework for analysis of certain types of key planning problems facing the Division of Major Facility Project Management (MFPM). The chart reflects current ERDA/FE practice, as well as added refinements derived from external documents such as OMB Circular A-109 and DOD Directive 5000.1. A conceptual and working definition of MFPM's Design and Technical Support activities is derived; techniques for planning these activities and implementing their results are recommended. An early application of dependency network methodology to a specific problem, such as the planned Atmospheric Fluidized Bed Combustion demonstration plant project, is recommended.

CARBONIZATION

REFER ALSO TO CITATION(S) 5823, 5825

5771 **Standardizing effluents from coking plants.** Privator, V.E. *Koks Khim.;* No. 11, 36-38(Nov 1976).

Effluents should be mechanically and biologically treated and returned to the plant cycle or discharged into the municipal system. The basic requirements are constant composition and regular output. Limit concentrations were established for biological treatment: volatile ammonia not more than 200 mg/l, total ammonia 4,000 mg/l, thiosulphates 300 mg/l, tars and oils 50 mg/l. All other components are normally well below the limit quantities.

5772 **Preheating coal for coking.** Pokrovskaya, F.I.; Semenenko, V.D. *Koks Khim.;* No. 8, 53-56(Aug 1976).

Paper reviews worldwide experience in preheating and is based on facts and figures from the U.S.A., South Africa, France, the U.K. and West Germany. A table is provided showing construction and capacity, method, coal temperature, charging, number of batteries and increase in productivity, etc. Details are included on the Brookhouse operation.

5773 **Effect of charge moisture on coking time.** Bronnikov, V.K. *Koks Khim.;* No. 8, 12-14(Aug 1976).

In a series of trials at Yasinovka, with charges ranging from 8 to 15% moisture, the shortest coking time was achieved with a 9.5% moisture charge. Mathematical and statistical treatment of the results of the experiment revealed close correlation between coking time and moisture.

5774 **Ways of increasing oven capacity.** Silka, A.N. *Koks Khim.;* No. 8, 17-20(Aug 1976).

Increased height and length of oven increases throughput and saves in overheads. Increase in width however is said to have opposite effects. An oven width of 410 mm is recommended as giving more uniformly sized coke than a 450 mm oven. It is emphasized however that change in width does not appear to affect abrasion resistance of the coke.

5775 **Coking trials with charges containing 50% of gas coal.** Miroshnichenko, A.M. *Koks Khim.;* No. 8, 3-5(Aug 1976).

A 3-component charge containing 50% gas, 35% fat and 15% coking coal was used in a trial run at Khar'kov experimental coking works in an oven of 407 mm average width. Coking time was 14 hours and flue temperatures were 1350 to 1370 C. The coke was in no way inferior to conventional blast furnace coke. When the coking coal was replaced by a lean coal however, abrasion resistance and shatter strength both deteriorated. Another aspect of the 3-component charge was the more uniform screen analysis, with 74 to 77% of 60 - 25 mm as compared with the usual 56%, and a 10% reduction in the +60 mm yield. When the coking coal was replaced by lean coal, yield of +60 mm sizes increased.

5776 **Heat losses from coke oven surfaces under different coking schedule.** Zebilin, I.D. *Koks Khim.;* No. 7, 15-18(Jul 1976).

The study was based on standard Giprokoks batteries. When the flue temperature was raised from 1370 to 1385 C (coke side) the total heat losses to the environment from the top and sides of the battery rose by as much as 16%: increase to 1410 C increased losses by 22%. The heat loss to atmosphere per kg of wet charge rose from 32.9 to 37.0 kCal when the flue temperature was increased from 1370 to 1385 C.

5777 **Interaction of coals in the plastic state.** Chernyshov, Yu.A. *Koks Khim.;* No. 6, 11-12(Jun 1976).

Six coal charges were examined, containing proportions of gas coal between 35 and 50%, and compared with blends of other coals. It was concluded that blends of coals differing widely in rank should not be used.

5778 **Optimum oven width.** Syskov, K.I. *Koks Khim.;* No. 6, 13-19(Jun 1976).

Oven width is one of the factors determining quality of coke. Increase in the coking rate not only improves the strength of the coke and reduces its size but also makes this difficult to grade by existing standards. To establish the effect of oven width indices have to be used that characterize the changes during coking, typically bulk permeability of the mass of coke. Narrow ovens give better coke with charges of lean coals. A number of tables are reproduced showing plastometric indices, flue temperature, coking time and end strength for a wide range of charge variations.

5779 **Blends with higher proportions of poor-caking coals.** Leonor, A.S. *Coke Chem., USSR (Engl. Transl.);* No. 1, 3-5(1976).

As a result of commercial-scale carbonization and smelting trials, the authors conclude that weakly coking coals can be used in higher proportions in blends without detriment to blast-furnace performance, if the blend compositions are adjusted to make fullest use of the available coking capacity of the coals. One blend should contain most of the available grade Zh and K coals of limited caking capacity, and another blend (or stream within a given plant) should contain coals of superior caking capacity. Savings can be made by carbonizing the two types of blend in separate coke-oven plants rather than as streams in the same plant.

DESULFURIZATION AND PURIFICATION

REFER ALSO TO CITATION(S) 5785, 5802

5780 **Desulfurization of model coal sulfur compounds by coal mineral matter and a cobalt molybdate catalyst. I. Thiophene.** Morvoka, S.; Hamrin, C.E. *Chem. Eng. Sci.;* **32**: No. 2, 125-133(1977).

A continuous-flow differential reactor was used to obtain rate equations for the reaction of thiophene and hydrogen over coal

mineral matter and a cobalt-molybdate catalyst. Coal mineral matter in its least altered state was obtained by low temperature ashing of Western Kentucky No. 9 and No. 11 coals in an oxygen plasma. Pretreatment of both coal mineral matter and catalyst with hydrogen sulphide increased thiophene reaction rates considerably, but introduction of the gas with reactants markedly decreased the rate.

HYDROGENATION

REFER ALSO TO CITATION(S) 5790, 6956

GASIFICATION

REFER ALSO TO CITATION(S) 5801, 5844, 5855, 6112, 6113, 6612, 6956, 7465

5781 (ANL/CEN/FE—77-2) **Laboratory support for in situ gasification reaction kinetics. Quarterly report, January—March 1977.** Fischer, J.; Young, J.E.; Johnson, J.E.; Bowyer, D.C.; Jonke, A.A. (Argonne National Lab., Ill. (USA)). Jun 1977. Contract W-31-109-ENG-38. 20p. Dep. NTIS, PC A02/MF A01.

This work is directed toward support studies for the national endeavor on in-situ coal gasification. The objective is to determine the reaction-controlling variables and reaction kinetics for gasification of chars resulting when coal is pyrolyzed in underground gasification. The reactions to be studied include steam-char, CO_2-char, H_2-char, and the water-gas shift reaction. Kinetic data related to the reaction of steam with Wyodak subbituminous coal are presented. The temperature dependence of the reaction, the apparent reaction order with respect to steam, and the inhibitory effects of hydrogen are discussed.

5782 (CONF-770652—9) **Kinetics of char gasification reactions under conditions of underground coal gasification.** Young, J.E.; Fischer, J.; Johnson, J.E. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 29p. Dep. NTIS, PC A03/MF A01.

From 3. annual underground coal conversion symposium; Fallen Leaf Lake, California, United States of America (USA) (6 Jun 1977).

This project is directed toward support studies for the national endeavor on in situ coal gasification. The objective is to determine reaction-controlling variables and reaction kinetics for gasification of chars resulting from pyrolysis of coal in underground gasification. The data obtained from these studies are used in the mathematical modeling of in situ gasification systems, in order to understand and interpret field experimental data and to design future field studies. The reactions being studied include steam-char, CO_2-char, and water gas shift reactions, as well as methane-producing reactions such as the methanation of CO or the hydrogen-char reaction. The kinetics studies are carried out in a packed bed differential reactor in which steam, H_2, CO_2, and/or other reactants are blended with N_2 to obtain the desired total pressure and partial pressures of reactants. The preparation of the char is carried out immediately prior to gasification in the reactor under conditions of pressure, heating rate, and sweeping gas composition similar to those encountered in underground gasification. The coals studied include Wyodak and Hanna subbituminous coals and Pittsburgh seam high volatile bituminous coal. Kinetic data are reported for the reaction of steam with chars prepared from the Wyodak and Hanna coals. The dependence of the reaction rate on the partial pressures of reactant steam and product hydrogen is described. The temperature dependence of the reaction rates indicates that diffusion of reactants and products through pore structure of Hanna char limits the reaction more severely than in the case of the Wyodak char. The rate of reaction of steam with Wyodak char is approximately 50% greater than the rate observed with the Hanna char. The reaction order with respect to steam at low partial pressures of steam varies from 0.5 to approximately 1. Preliminary information is also reported for reaction of steam with chars prepared from Pittsburgh seam coal.

5783 (COO—0004-1) **Design, develop, and manufacture process gas lubricated hot recycle gas circulators. Final technical report, MTI—77TR5.** Dominy, D.G.; Hurley, J.D. (Mechanical Technology, Inc., Latham, N.Y. (USA)). Oct 1976. Contract EY-76-C-02-0004. 150p. Dep. NTIS, PC A07/MF A01.

In the SYNTHANE coal gasification process raw product gas of approximately 35 mole % methane is passed through a methanator which increases the methane content (and heating value) to approximately 86 mole % methane. The reaction is highly exothermic. In order to limit the temperature rise of the reaction, high BTU methane process gas is diluted with raw product gas. A pressure increase is necessary to force the mixed gases back into the methanator. In addition, varying recycle ratios affect the total flow of the gas stream necessitating a compressor or other device to operate at varying flow capacities. The present hot gas recycle methanator system utilized an eductor to mix and raise the pressure of the product gas. This method has limitations. The pressure rise is small, in the order of 1/2 psig, and the eductor does not allow proper mixing pressures and temperatures if the flow conditions are changed. An eductor is useful for this purpose only in a pilot plant and represents an expedient solution to the problem. For commercial use a compressor is essential.

5784 **Review of gasification for power generation.** Robson, B. (National Coal Board, Cheltenham, Eng.). *Int. J. Energy Res.;* **1**: No. 2, 157-177(1977).

The state of the art of gasification of coal for power generation is reviewed. The major part of the review is a description, under the headings of fixed-bed gasification, fluidized-bed gasification, entrained gasification, and molten-bath gasification, of the work now in progress. The only large-scale operational plant is in the Federal Republic of Germany at the Steag plant, which is based on Lurgi fixed-bed technology. Another large-scale plant which seems certain to be built is the Commonwealth Edison plant, also to use Lurgi gasifiers. All other work is still in the development stage and unlikely to reach commercial scale for several years. It is hoped that this will coincide with the time when gas turbines can withstand inlet temperatures of 1200°C or higher. The review describes the current conventional methods of power generation, outlines the three basic types of combined cycle, and then explains why the juncture of gasification and a combined cycle is attractive. This is followed by a section on the quality of gas required for firing gas turbines, and a short outline of equipment available for coal gasification. 27 references.

5785 (FE—1514-69) **Advanced coal gasification system for electric power generation. Quarterly progress report third quarter, fiscal year 1977, April 1—June 30, 1977.** Salvador, L.A.; Keairns, D. (Westinghouse Electric Corp., Lester, Pa. (USA). Generation Systems Div.). 1 Aug 1977. Contract EX-76-C-01-1514. 87p. Dep. NTIS, PC A05/MF A01.

A unique coal gasification system employing multiple fluidized beds has been embodied into a process development unit located at Waltz Mill, Pa. The two main process loops are at present arranged for independent operation. The devolatilizer/desulfurizer subsystem testing on coal was previously completed, after a 168-hour continuous run processing two highly-caking Pittsburgh seam coals. The gasifier/agglomerator subsystem is now undergoing test operation. An improved concentric fines feeding system was successfully tested during this quarter.

5786 (FE—1514-71) **Advanced coal gasification system for electric power generation. Sixty-first monthly progress report, August 1977.** Keairns, D.L.; Salvador, L.A. (Westinghouse Electric Corp., Lester, Pa. (USA). Generation Systems Div.). 15 Sep 1977. Contract EX-76-C-01-1514. 20p. Dep. NTIS, PC A02/MF A01.

The contract approval to procure equipment and subcontract services for installing integrated hardware for the PDU was not obtained in August as expected. As a result, the program has been delayed five weeks. Every effort will be made to reduce this delay time, following receipt of a formal ERDA approval to proceed, by expediting hardware and planning for efficient use of time, manpower and other resources during construction. Work on the PDU is described under the following headings: Gasifier Tests; Integrated Operations; PDU Engineering and Design; PDU Maintenance, Construction, and Operation; and Work Planned for September. Laboratory support studies are described under the headings: Combustor-Gasifier Test Program Support; Devolatilizer; Coal Behavior; Ash Behavior; Sorbent Behavior; Reactor Analysis; and Work Planned for September.

5787 (FE—2210-16) **Study of heat transfer through refractory lined gasifier vessel walls. Quarterly progress report, March—May 1977.** Schorr, J.R. (Battelle Columbus Labs., Ohio (USA)). Jun 1977. Contract EX-76-C-01-2210. 42p. Dep. NTIS, PC A03/MF A01.

The design of refractory linings for coal gasification vessels is important to the reliable and cost-effective operation of the process. The objective of this program is to develop an empirically derived computer model suitable for use by the vessel designer to determine heat flow through multicomponent, refractory-lined gasifier vessel walls, so that the effects of parameters such as lining thickness, density, refractory composition, physical form, metal anchor spacing and configuration, and gas pressure and composition can be predicted. The program includes the design, construction, and operation of test apparatus for evaluating these parameters which influence heat flow through refractory lining materials.

5788 (FE—2210-19) **Study of heat transfer through refractory lined gasifier vessel walls. Monthly technical progress report, August 1977.** (Battelle Columbus Labs., Ohio (USA)). Aug 1977. Contract EX-76-C-01-2210. 6p. Dep. NTIS, PC A02/MF A01.

This is the sixteenth month of a 22-month study to evaluate heat transfer through refractory lined coal gasification vessel walls. The objectives of this program include development of an empirically derived computer model suitable for determining the heat flow through complex, multicomponent refractory linings, such that the effect of lining thickness, density, composition, anchors, gases, and

other significant parameters can be predicted. The program involves both the development of a heat flow computer model and the experimental measurement of heat flow in a test apparatus especially designed and constructed for this program.

5789 (FE—2240-44) **Mechanical development recommendations.** Wilson, A.L. (Braun (C.F.) and Co., Alhambra, Calif. (USA)). Jun 1977. Contract EX-76-C-01-2240. 178p. Dep. NTIS, PC A09/MF A01.

A shortage of natural gas has stimulated the development of methods for converting coal into pipeline quality gas. Several promising new processes are being sponsored under the joint ERDA-A.G.A. program. Those processes employ severe operating conditions in order to achieve efficient coal conversion. The severe conditions of temperature, pressure, corrosion, and erosion places a strain upon existing technology. The coal gasification processes are scheduled for pilot plant operation at three to five tons of coal per hour. The more promising processes may be scaled up to demonstration plant size of 150 to 450 tons of coal per hour. The success of any demonstration plant will depend largely upon having reliable mechanical equipment. This report gives the results of a study of mechanical equipment needed by a large coal gasification plant. It was found that certain items of mechanical equipment are lacking in the sense that they are either unavailable or unproven for the large size and severe service. Mechanical development programs are recommended in the following categories: coal identification, size reduction, drying, classification, storage, and handling; coal feed injection into gasifier; large size valves; solids removal from gaseous streams; power recovery expanders; waste heat boilers; and test facility.

5790 (FE—2305-14) **Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Monthly progress report, Aug 1977.** Cronauer, D.C.; Jewell, D.M.; Shah, Y.T.; Kueser, K.A. (Gulf Research and Development Co., Pittsburgh, Pa. (USA)). Sep 1977. Contract EX-76-C-01-2305. 12p. Dep. NTIS, PC A02/MF A01.

Compounds having oxygen functional groups are being studied as model acceptors, with emphasis on hydroxyl and ketonic groups. Experiments have also been performed with various acceptors using either partially deuterated tetralin or conventional tetralin in the presence of a deuterium gas phase. Work is also reported on the use of solvents labeled with carbon 13.

5791 (FE—2361-4(Vol.3)) **Development of a fast fluid bed gasifier. Phase 1, Task 1. Interim report, July—October 1976. Volume III. Appendix B: drawings.** Molayem, B. (Hydrocarbon Research, Inc., Trenton, N.J. (USA)). Feb 1977. Contract EX-76-C-01-2361. 20p. Dep. NTIS, PC A02/MF A01.

Results are presented in the form of 18 drawings; there is no text.

5792 (FE—2370-12) **Coal mine-coal conversion plant interface evaluation and conceptual design. Quarterly technical progress report, January 16—April 15, 1977.** (Bechtel Corp., San Francisco, Calif. (USA)). Jul 1977. Contract EX-76-C-01-2370. 102p. Dep. NTIS, PC A02/MF A01.

During the quarter, effort was directed toward Tasks 2.2 — Regional Transport Evaluation and 2.3— Interface Tradeoff Studies, which were completed, and Tasks 2.4 — Interface Conceptual Design and 2.5 — Interface Cost Estimates, which will continue into the final quarter of the project. Two project review meetings were held. Major topics considered, in addition to project progress, included: establishment of a five train coal conversion plant; use of private industry economics for economic analysis; relative quantities of coal to be transported by barge and rail from regional coal mines to a remote coal conversion plant; and capital and operating cost estimating approaches. The rail transport alternative for the Regional Coal Mining-Remote Coal Conversion Plant Site alternative was completed and is presented in abbreviated form. Approximately one-third of the coal will be transported by rail for this alternative, and the remainder will be transported by barge. Rail transport is generally more expensive per ton-mile than barge transport. A decision was made to use a coal-fired atmospheric pressure fluidized-bed steam/gas generator for production of steam and hot flue gas for use in simultaneous coal drying and pulverizing. Steam would be used for power generation and fulfilling any process steam requirements. Process flow diagrams for the selected steam/gas generator design are presented.

5793 (FE—2370-14) **Coal mine-coal conversion plant interface evaluation and conceptual design, Phase II. Monthly technical progress report, 1 May—31 May 1977.** (Bechtel Corp., San Francisco, Calif. (USA)). Jun 1977. Contract EX-76-C-01-2370. 34p. Dep. NTIS, PC A03/MF A01.

This project is being performed in two sequential phases: Phase I — Interface Overview Investigation, and Phase II — Interface Conceptual Engineering and Cost Estimating. Work covered in this report is associated with Phase II. A decision was made to use the atmospheric pressure fluidized-bed (AFB) power plant developed for the General Electric Energy Conversion Alternatives Study as a basis for design and cost estimating for the interface Steam/Gas Generation and Power Generation Facilities. A meeting was held to obtain additional information for design of interface solid wastes handling, treatment, transport, and disposal facilities. Major engineering effort was directed toward completion of conceptual designs for the two coal pulverizing/separation facilities (the ball tube mill system and the roller mill system) and the solid wastes facilities. Final conceptual design drawings for all three components, fan building, mill building, and coal/gas separation, which constitute the pulverizing/separation facilities for both coal mill alternatives are presented in this report. For disposal of solid wastes from both the actual coal conversion process and interface operations (principally the AFB steam/gas generators, primary coal breaking, and, if used, partial coal cleaning) a slurrying, pumping, and surface impoundment system has been engineered.

5794 (FE—2433-13) **Environmental assessment of the HYGAS Process. Monthly progress report, April 1—April 30, 1977.** (Institute of Gas Technology, Chicago, Ill. (USA)). Aug 1977. Contract EX-76-C-01-2433. 25p. Dep. NTIS, PC A02/MF A01.

Hygas tests were carried out with Montana subbituminous nonagglomerating coal and with Illinois bituminous coal. Sulfur-by-species determinations were completed on reactor solids for some tests, and concentrations of selected pollutants in Hygas aqueous streams are also reported for one test. Final data from one test indicated that Be, V, Mn, Zn, Li, Cr, and Pb essentially remained in the ash, and from 50 to 90 percent of the Fe, Ba, As, B, F, Tl, Ni, Cu, and Mo also remained in the ash. The most reactive elements were Cl, Se, Cd, and Hg with less than 50 percent recovery in the ash. An ash balance also implied that Fe, As, Se, Tl, Ni, Cu, Cd, and Mo were primarily released in the steam-oxygen zone; Ba, B, Cl, and Hg were primarily released in the first and second stages of gasification. There is some evidence for the accumulation (by an unknown mechanism) of Fe, Tl, Ni, Cu, Cd, Pb, Mo, and Cr in the upper, cooler sections of the gasifier. A comparison of trace element analyses with earlier tests with lignite shows that they agree for Li and Mn but that substantial differences are evident for the remaining comparable trace elements. The production of selected pollutants in Hygas water effluents is presented on a normalized basis. Rudimentary S material balances around the pretreater and around the gasifier are presented as an aid in ascertaining the ultimate fate of S during gasification.

5795 (ORO—5081-12) **Electromagnetic wave propagation within a subsurface coal seam for in-situ gasification application. Progress report, May 1, 1976—April 30, 1977.** Holmes, J.J.; Balanis, C.A. (West Virginia Univ., Morgantown (USA). Dept. of Electrical Engineering). 1977. Contract EY-76-S-05-5081. 135p. Dep. NTIS, PC A07/MF A01.

Two types of electromagnetic systems are investigated analytically and proposed for the monitoring of the underground gasification process. The first type, called the reflection monitoring system, consists of a transmitter and receiver placed on the same side of the gasified coal section. The model of this system is developed in steps using the geometrical optics (GO) technique. The GO method of formulation is linked strongly to the classical and well established Sommerfeld model technique. The GO method is found to be accurate at low frequencies, where it is not normally considered valid, and becomes more accurate at the higher frequencies used for the monitoring system. A swept frequency monitoring scheme is demonstrated for the reflection-type system, showing considerable sensitivity in the detection of the burn front of the gasified section. The second type, called the transmission monitoring system, consists of a transmitter and receiver placed on opposite sides of the gasified coal section. This system is modeled using the transmission equation of geometrical optics developed here. The swept frequency response of the model, for the transmission monitoring system, is used to investigate a monitoring scheme for the measurement of the overall width of the gasified section. The swept frequency transmission monitoring system is not as sensitive to changes in the overall length of the gasified section as is the reflection system to changes in the leading edge of the burn.

5796 (SAND—77-8260) **Formation of protective layers on alloys in coal processing environments. Annual report, February 1, 1976—March 31, 1977.** Adolphson, D.R. (comp.). (Sandia Labs., Livermore, Calif. (USA)). Jul 1977. Contract EY-76-C-04-0789. 98p. Dep. NTIS, PC A05/MF A01.

Short time (24-hr) screening tests at 1000°C in simulated coal gasification atmospheres have demonstrated the effectiveness of additions of Ti and Al in reducing the corrosion of type 310 stainless steel and Ni-30 Cr. Mo also reduced the corrosion rate but not to an acceptable degree. A high-pressure high-temperature corrosion cell has been built. It is intended to provide a seven component gas atmosphere at 1000 psi and 1000°C. The system is currently being proven out prior to the initial 1000-hr run. Based solely on thermodynamic stability (formability), solubility, and sulfide melting temperature data, the following observations can be made: an intrinsic

problem exists in that elements which are strong sulfide formers are generally less soluble in such matrix elements as Fe and Ni; the group IIIB, IVB, and VB elements appear to offer the best compromise with regard to both thermodynamic stability and solubility, although the solubility limits may still be unsuitable; and the stable sulfide formers generally tend to show greater solubility in Ni greater than Fe greater than Mn. It is not possible to design, a priori, the ideal alloy for use in a coal gasification environment, since so many different parameters must be considered, parameters which may be unknown, uncharacterized, and interrelated. However, thermodynamic generalizations and trends can be used to give direction with regard to protective sulfide layer formation, and various generalization approaches have been reviewed in this paper to stimulate thought.These generalizations and trends have been presented in terms of the periodic arrangement, and one can use this common arrangement when comparing and correlating various parameters of interest.

5797 (UCRL—50026-77-1) **LLL in situ coal gasification program. Quarterly progress report, January—March 1977.** Thompson, D.S.; Madsen, S.K. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Jun 1977. Contract W-7405-ENG-48. 35p. Dep. NTIS, PC A03/MF A01.

During the second quarter of FY 1977, plans for a second major in situ gasification experiment at the Hoe Creek, Wyoming site were made. To increase understanding of the potential environmental effects of underground coal gasification, water from wells drilled at and around the site of Hoe Creek Experiment No. 1 was sampled. Contracts were granted for the development of a shaped charge that may be used to establish a permeable channel between production and injection wells. Attempts were also made to increase the accuracy of methods of predicting permeability enhancement caused by high explosives. The model of the gasification process was further refined this quarter. Considerable attention was devoted to newly available reports on Soviet-bloc underground coal gasification experiments.

LIQUEFACTION

REFER ALSO TO CITATION(S) 5792, 5793, 5844, 5880, 6956, 7465

5798 (FE—1224-68) **Project Lignite. Quarterly technical progress report No. 10, July, August, and September 1976.** Severson, D.E. (North Dakota Univ., Grand Forks (USA). Engineering Experiment Station). 7 Mar 1977. 303p. Dep. NTIS, PC A14/MF A01.

Additional runs were attempted under various operating conditions using the liquefaction section of the PDU. Some difficulties were encountered. Some low-ash solvent-refined lignite (SRL) was produced, but product quality was not consistent. Continued major emphasis was given to maintenance of the PDU to allow operation. Laboratory autoclave testing of a Chilean lignite was completed with results comparable to those obtained with North Dakota lignite. Cost evaluation studies for three liquefaction processes (Synthoil, CBFFC, and SRL) at the same output indicated that the SRL processes had the lowest cost on a Btu basis. An economic study of electrical generation costs indicated that as-mined lignite had lower costs per kilowatt hour than did SRL in new generating facilities, either for mine mouth or load center facilities. SRL as a clean fuel might be justified for use in older or peaking plants by environmental considerations.

5799 (FE—1224-72) **Project Lignite. Quarterly technical progress report No. 11, October, November, and December 1976.** Severson, D.E. (North Dakota Univ., Grand Forks (USA). Engineering Experiment Station). 5 May 1977. Contract EX-76-C-01-1224. 207p. Dep. NTIS, PC A10/MF A01.

Six runs were made using the liquefaction section of the PDU. One complete run and part of another included operation of the solid-liquid separation unit. Following the second run the use of the deashing unit was discontinued until a larger unit is ready for service. The liquefaction section generally operated well. Pressures lower than 2500 psig result both in lower total oil and in lower effective solvent production. In all cases, yields were less than 100% of the solvent charged. With ratios of H_2/CO other than 1/1 at 2500 psig, the total yields did not differ greatly from those obtained when using 1/1 H_2/CO as the feed gas. However, recovery of effective solvent was maximum when the feed gas was 50 to 60% H_2. Use of pure H_2 as feed gas resulted in relatively low conversion and oil yield.

5800 (FE—2007-35) **Filtration process and equipment studies for coal liquefaction processes. Monthly report, July 1977.** Smith, G.R.S.; Martin, P.C. (Johns-Manville Sales Corp., Denver, Colo. (USA)). 8 Aug 1977. Contract EX-76-C-01-2007. 7p. Dep. NTIS, PC A02/MF A01.

Filtration characteristics of Wilsonville Filter Feed stock (SN 25260, Emery Feed Coal from Utah) were studied during the course of sixteen experimental runs performed on the rotary pressure precoat filter test leaf. Tests at 70 psid, 600°F indicated equal filtration rates at 1 mil/cycle and 2 mil/cycle knife blade advance. Filtration rates at 100 psid, 600°F were in excess of 750 pounds/hour/square foot. A design was completed for a device to permit in situ precoating.

5801 (FE—2007-36) **Filtration process and equipment studies for coal liquefaction processes. Monthly report, August 1977.** Smith, G.R.S.; Hodge, J.A. Jr. (Johns-Manville Sales Corp., Denver, Colo. (USA)). 6 Sep 1977. Contract EX-76-C-01-2007. 11p. Dep. NTIS, PC A02/MF A01.

During August 1977, the following sets of runs were completed on the Rotary Pressure Precoat Filter Test Leaf, using Tacoma Filter Feed: AF5 precoat with 1 mil/cycle blade advance at 70 psid and 600°F: Rates were in the range of 280 to 410 pounds/hour/square foot and were quite close to identical runs in June. AF2 precoat with ½ and 1 mil/cycle blade advance at 70 psid and 100 psid and 600°F: Rates ranged from 220 to 520 pounds/hour/square foot and indicated that the finer diatomite might be practical on a large scale. The test leaf system was revised to allow in situ operation for future runs. The revised construction and planned operation for September has been described for its use on Tacoma Filter Feed with precoats of AF5, AF6, and Standard SUPFR-CEL.

5802 (FE—2011-8) **Catalysts for upgrading coal-derived liquids. Quarterly report, March 9—June 8, 1977.** Cryness, B.L. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). 17 Jun 1977. Contract EX-76-C-01-2011. 32p. Dep. NTIS, PC A03/MF A01.

Two experiments were conducted for catalyst assessment, and the results from another two experiments are given. These results along with others reveal that Synthoil I liquid can not be successfully hydroprocessed in our reactors at 800°F (427°C), 1500 psig and for volume hourly space times greater than 1.5 hr. Another Synthoil liquid (Synthoil II) obtained from the same coal and operational conditions as was Synthoil I proved to be less resistant to hydroremoval of S and N. A 100-hr activity test with Synthoil II indicated significant N removal activity decay yet none for that of S removal. The Catalyst Life Test Unit was satisfactorrily tested through 210 hr of continuous operation using the raw anthracene oil feedstock. Another test was performed using a heavier fluid, Synthoil II, and pumping problems were encountered. The principal compound types present in the asphaltene neutrals isolated from an FMC coal liquid have been identified. The identification is based upon mass spectral data obtained from a CEC 21-110B mass spectrometer using 70-eV electrons and a resolution of ca. 20,000 and a AEI MS—50 mass spectometer using low-voltage electrons and a resolution of ca. 40,000. Principal structural types identified include aromatic hydrocarbons possessing 1 through 7 aromatic rings and aromatic ethers of the furan and thiophene type. A number of the Z series are found to be common to both the asphaltene and oil neutrals. This observation is consistent with the observation that the asphaltene neutrals are 87 percent soluble in pentane. Saturated hydrocarbons account for 22-25 percent of the asphaltene neutrals.

5803 (FE—2031-3) **Chemistry and structure of coal-derived asphaltenes, Phase I. Quarterly progress report, January—March 1976.** Yen, T.F.; Schwager, I. (University of Southern California, Los Angeles (USA)). 1976. Contract EX-76-C-01-2031. 20p. Dep. NTIS, PC A02/MF A01.

Coal liquids have been separated by solvent fractionation into three crude fractions: pentane-soluble (gas oil and resin), pentane-insoluble and benzene-soluble (crude asphaltene), and benzene insoluble (carbene and carboid). The crude asphaltene fractions have been further separated by solvent elution chromatography on silica gel into two major fractions (benzene eluted and diethyl ether eluted). The great majority of these materials were characterized as to elemental analyses, molecular weight, metal analyses, color intensity, NMR—hydrogen percentages by proton type, carbon aromaticity by x-ray diffraction, and infrared spectral analysis. The two major asphaltene fractions obtained from Synthoil by elution from silica gel with benzene and diethyl ether compare relatively well with respect to ultimate analysis with the two components isolated by Sternberg et al. by treatment of Synthoil asphaltenes dissolved in toluene with dry HCl. If these components prove to be similar, then silica gel chromatography offers a mild, chlorine-free procedure for separating asphaltenes into acidic and basic components.

5804 (FE—2202-18) **Homogeneous catalytic hydrocracking processes for conversion of coal to liquid fuels: basic and exploratory research. Quarterly report No. 6, February 1, 1977—April 30, 1977.** (SRI International, Menlo Park, Calif. (USA)). 15 Jul 1977. Contract EX-76-C-01-2202. 72p. Dep. NTIS, PC A04/MF A01.

Results are reported on the following tasks: Homogeneous Catalysis—Acid Catalysis; Hydride-Promoted Coal Conversion; Advanced Coal/Solvent Studies; Thermodynamic and Kinetic Analysis of Coal Liquefaction Chemistry; and Coal Structure Studies.

5805 (FE—2244-8) **Flash pyrolysis coal liquefaction process development. Quarterly report, October—December 1976.** Knell, E.W.; Gethard, P.E.; Shaw, B.W.; Green, N.W.; Qader, S.A. (Occidental Research Corp., La Verne, Calif. (USA)). Feb 1977. Contract EX-76-C-01-2244. 48p. Dep. NTIS, PC A03/MF A01.

The second and third PDU runs were concluded this quarter which completes the first major program, Subtask 1-1, PDU Shakedown. The unit ran extremely well and all the objectives of this run were achieved. During the last 7 days of the third run, 16 tons of coal were processed at the rate of 2.4 TPD. For one 12-hr period a rate of 3.5 TPD was achieved. Nearly 1.1 tons of tar were recovered from this run. Material balances for the bench scale runs are reported. The optimal tar yield of 16.7% MAF from subbituminous coal was obtained at 1200°F with a residence time of 1.5 sec. The data indicates that, depending on the selection of the residence time, the maximum tar yield for the PDU will occur over the temperature range 1000 to 1200°F. The yield of char decreases when either the temperature or the residence time is increased, but under these same conditions the gas yield increases. Characterization of the tar from the bench scale runs is producing a wealth of information. For example, while the tar composition appears to be independent of the pyrolysis temperature over the range 1000 to 1400°F it is sensitive to residence time. The first analytical data on tar produced in the PDU were obtained this quarter. The I.R. ratio of aliphatic to aromatic C—H bonds is being studied as a method for monitoring steady state composition in the tar collection system.

5806 (FE—2244-13) **Flash pyrolysis coal liquefaction process development. Monthly report, May 1977.** Knell, E.W.; Gethard, P.E.; Shaw, B.W.; Green, N.W.; Qader, S.A. (Occidental Research Corp., La Verne, Calif. (USA)). Jun 1977. Contract EX-76-C-01-2244. 14p. Dep. NTIS, PC A02/MF A01.

The first PDU tests pyrolyzing bituminous coal since inception of the program were conducted this month. An experimental matrix comprising ten sets of operating conditions is being followed in the initial tests. The unit was successfully operated and the reactor design criteria were confirmed under the three conditions tested thus far. Material balances from PDU Runs 122 and 123 were completed. Lower tar and higher gas yields were obtained from the PDU as compared to the bench-scale reactor under similar operating conditions. Further subbituminous coal pyrolysis yield tests in the PDU will be made to check these results. A 40-hr hydrotreater run was made processing tar produced in the PDU. Excellent unit performance, tar conversion, and material balance results were achieved.

5807 (PERC/RI—77/12) **Screening for hazardous elements and compounds in process streams of the 1/2 ton per day SYNTHOIL process development unit.** Lett, R.G.; Schmidt, C.E.; DeSantis, R.R.; Shsarkey, A.G. Jr. (Energy Research and Development Administration, Pittsburgh, Pa. (USA). Pittsburgh Energy Research Center). Sep 1975. 35p. Dep. NTIS, PC A03/MF A01.

The major process streams from a coal liquefaction run on the 1/2 ton per day SYNTHOIL Process Development Unit at the Pittsburgh Energy Research Center were screened for potentially hazardous elements and compounds. Concentrations of 60 to 70 trace and minor elements in each stream were determined by spark source mass spectrometry. With the exception of sulfur and a few very volatile trace elements, elemental concentrations in the product oil and residue can be estimated from ash contents; the relative distribution of elements was similar to that of the feed coal. High resolution mass spectrometry was used to screen for the possible presence of several hundred potentially hazardous compounds. Little variation was found in the number and types of compounds which could be present in the major process streams examined. Potentially hazardous alkylated polynuclear aromatics were present in higher concentrations than the corresponding unsubstituted polynuclear aromatics.

PYROLYSIS AND CRACKING

REFER ALSO TO CITATION(S) 5782, 5805, 5806

5808 **Pyrolytic chromatography of coal and of montan waxes.** Pistekand, P. *Sb. Pr. UVP;* No. 32, 208-283(1976).

Results of investigations of the pyrolysis of fossil fuels are given. Samples of brown coal, hard coals, macerals, lignites and waxes were subjected to pyrolysis at 700°C in a tin bath. Identification of the products was carried out on the basis of comparison of elution data with standards with the aid of the Kovats indices, and by mass spectrometry. Pyrolytic spectra contained hydrocarbons from C5 up to anthracene and phenanthrene. The products of pyrolysis depend on the temperature and the degree of coalification.

SOLVENT EXTRACTION

REFER ALSO TO CITATION(S) 5798, 5799, 5800

5809 (FE—496-139) **Solvent refined coal (SRC) process. Monthly report, August 1977.** (Pittsburg and Midway Coal Mining Co., Merriam, Kans. (USA)). Sep 1977. Contract EX-76-C-01-0496. 14p. Dep. NTIS, PC A02/MF A01.

The progress of the Solvent Refined Coal (SRC) Project by the Pittsburg and Midway Coal Mining Co., at the SRC Pilot Plant at Fort Lewis, Washington, and the P and M Laboratory in Merriam, Kansas, for the Energy Research and Development Administration for the month of August, 1977 is summarized. During August, the Fort Lewis Pilot Plant processed a blend of Kentucky Nos. 9 and 14 coal during 31 days of operation in the SRC II mode. Four SRC II material balance runs were completed during this period. Eight exploratory SRC II runs on coals other than the Kentucky Nos. 9 and 14 to determine their suitability for processing in the SRC Pilot Plant were made at the Merriam Laboratory.

BY-PRODUCTS

5810 **Analytical note. A method for evaluating granular active carbon adsorption efficiency.** Sylvia, A.E. *J. Am. Water Works Assoc.;* 69: No. 2, 99-102(Feb 1977).

The rapid fluorescence method was used to evaluate the relative adsorption efficiency of 4 types of commercially available (US) granular active carbon demonstrating the existence of substantial differences in their adsorption efficiency for organic compounds.

PROPERTIES

REFER ALSO TO CITATION(S) 5807, 5808, 5821, 5853, 5854, 5858

5811 (FE—2031-1) **Chemistry and structure of coal-derived asphaltenes, Phase I. Quarterly progress report, July—September 1975.** Yen, T.F. (University of Southern California, Los Angeles (USA)). Aug 1977. Contract EX-76-C-01-2031. 16p. Dep. NTIS, PC A02/MF A01.

The first phase of a project for the investigation of the chemistry and structure of coal-derived asphaltenes has been initiated. Asphaltenes have been isolated from the products originated from three different coal liquefaction processes. Duffy's procedure has been applied to these crude asphaltenes to remove the contaminated resin. Updated results indicate that the asphaltene as obtained conventionally from solvent fractionation still contains fair amounts of polar resin.

5812 (FE—2031-2) **Chemistry and structure of coal-derived asphaltenes, Phase I. Quarterly progress report, October—December 1975.** Yen, T.F. (University of Southern California, Los Angeles (USA)). 1975. Contract EX-76-C-01-2031. 28p. Dep. NTIS, PC A03/MF A01.

Based on x-ray diffraction, a method has been developed for characterizing coals and coal-derived asphaltenes. The parameter thus obtained is termed aromaticity, an indicator for the amount of carbon atoms in the skeleton which is being aromatic. Provisional data indicate fairly large amounts of polar resin are still occluded in the crude asphaltene (separated by conventional pentane precipitation). This resin is more aromatic than the asphaltene from which the occluded resin has been removed. The extent of aromaticity has been estimated by both x-ray and color intensity methods.

5813 (PERC/RI—77/11) **Automatic recording plastometer for plastic properties of coal.** Wu, W.R.K.; Kirby, T. (Department of Energy, Pittsburgh, Pa. (USA). Pittsburgh Energy Research Center). Oct 1977. 25p. Dep. NTIS, PC A02/MF A01.

A new automatic recording plastometer for measuring the plastic properties of coal is described. It is operated at constant speed and variable torque. The torques produced in the plastometer during the plastic stage of coal are automatically plotted on a recorder as a function of heating temperature. Based upon the results from four coals with a wide range of fluidity, the repeatabilities of ten parameters of the plastometer test are shown to be at least comparable with those of corresponding parameters from dilatometer and other plastometer tests. A reaction mechanism of coal in the plastometer during the plastic stage is postulated.

5814 **Thermal breakdown of coke in a blast furnace.** Silonenko, Yu.Ya. *Koks Khim.;* No. 8, 20-22(Aug 1976).

A study of coke breakdown in the blast furnace underlines the changes in pore structure which take place due to gasification of the carbon in the coke. Porosity increases, and the cellular aspect of the coke diminishes with the general reduction in wall thickness. The most dramatic changes in the pore structure of the coke take place on the surface. Degradation occurs during charging and during descent within the furnace itself. Thermal stresses are produced by the temperature gradient arising over the section of the coke lump, governed by the difference in temperature between surface and

centre and by the thermo-physical properties of the coke itself. Typical coke skin and centre temperatures are tabulated, and graphs show the temperature gradient as a function of position in the furnace. The effect of coke size on the temperature gradient and the stresses that can occur are also presented. Maximum stress occurs at the bosh, about 2.5 times as much as at tuyere level, and stresses are greater the larger the coke size.

5815 Hot testing of coke. Balon, I.D. *Koks Khim.;* No. 7, 11-14(Jul 1976).

Earlier investigations failed to take full account of the factors affecting coke behavior within the blast furnace. An apparatus was accordingly developed for testing coke, based on a cyclone furnace where the sample could be held in a flow of hot oxidizing gases, simulating conditions in the blast furnace hearth. The results are said to be suitable for comprehensive assessment of the coke, including abrasive strength and its rate of gasification in a flow of carbon dioxide. Coke of size 6-10 mm tested at 1,100°C in an atmosphere of oxidizing gases close to those obtaining in the blast furnace hearth, indicated that destruction and total gasification of the coke occurs after 5 minutes for a weak coke and 8 minutes for strong coke, depending on the physico-chemical and physico-mechanical properties of the particular coke. When samples were treated for a fixed period (3 minutes), the amount of coke remaining, and the percentage over 6 mm varied between 22 and 40 and between 4 and 7 percent respectively.

5816 Study of the conditions for automated shatter testing. Bruk, A.S. *Koks Khim.;* No. 7, 18-21(Jul 1976).

An automatic apparatus for determining the shatter strength of coke is aimed at simulating the size degradation between wharf and blast furnace skip. A thorough investigation indicated that ten tests in the automated apparatus was a suitable programme, at any rate for Zaporozhstal work and coking plant. However, the test conditions naturally depend on the coke handling system at the individual plant.

5817 Group and individual analyses of hard coal extracts. Sindler, S. *Sb. Pr. UVP;* No. 31, 158-184(1976).

Paper summarizes methods of instrumental analysis usually used for analyzing complicated hydrocarbon mixtures. Methods suitable for analyzing solvent extracts of hard coals and products of their heat treatment are covered.

5818 Determination of the manganese content of coal ash. Lustigova, M. *Sb. Pr. UVP;* No. 32, 149-178(1976).

A spectrophotometric method for the determination of the manganese content of ash is based on the oxidation of Mn II to Mn VII with potassium periodate after separating interfering zinc oxide suspensions.

5819 Possibilities of influencing the caking property of coals by the admixture of various carbonaceous materials. Kunc, J. *Sb. Pr. UVP;* No. 30, 1-31(1975).

By means of laboratory methods (determination of the Roga caking index, and laboratory coking) materials which improve the caking of weakly caking coals were sought. Of the materials subjected to investigation, coal tar pitch, asphalite and pyrolytic resins proved the most advantageous. Heavy fractions from the vacuum distillation of petroleum were not satisfactory.

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 5771, 5792, 5793, 5828, 5844, 5848, 5878, 6559, 7435

5820 (BNL—50669) **Regenerative process for desulfurization of high temperature combustion and fuel gases. Quarterly progress report No. 4, January 1—March 31, 1977.** (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 34p. Dep. NTIS, PC A03/MF A01.

Processes for regeneration of lime and lime-based sorbents to be used in fluidized-bed combustion (FBC) are being developed. Carbon, silica, and coal ash (which contains significant amounts of carbon and silica) are being investigated as the regeneration agents. Kiln-type regenerators are being considered for the apparent solid-solid reactions involved in these processes.

5821 (CONF-770583—1) **Melting behavior of coal ash materials from coal ash composition.** Vorres, K.S. (Institute of Gas Technology, Chicago, Ill. (USA)). 1977. 7p. of Gas Technology, Chicago, IL.

From Fuel chemistry symposium on properties of coal ash; Montreal, Canada (May 1977).

The melting behavior and viscosity of coal-ash is important in the design of combustion equipment and coal conversion reactors. A number of correlations have used chemical composition to describe melting behavior and viscosity. Acids and bases have been important in these correlations. The role of the acid as a polymer former and the base as a polymer breaker is described. The concept of ionic potential derived from structural inorganic chemistry provides a useful measure of acid or base behavior. The relative concentration of available oxide ions from the bases affects the average size of polymeric aggregates and the viscosity of the melt. The gaseous environment can alter the state of the iron so that it can behave as either a base or an acid. Comparisons with earlier correlations are presented.

5822 (CONF-770943—2) **Limestone reactivities with SO_2 as determined by thermogravimetric analysis and as measured in pilot scale fluidized-bed coal combustors.** Snyder, R.B.; Wilson, W.I.; Johnson, I. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 22p. Dep. NTIS, PC A02/MF A01.

From 7. Thermal Analysis Society conference; St. Louis, Missouri, USA (26 Sep 1977).

A thermogravimetric analyzer was used to measure the reactivity of several limestones with SO_2. The laboratory results can be used to predict coal combustion results for pilot-plant atmospheric pressure fluidized-beds. The TGA information was fitted to two different straight-line least-squares fits, these equations allowed prediction by two different methods of calcium utilization in atmospheric-pressure pilot plant FBC's from knowledge of only the $CaCO_3$ content of the limestone. When predictions based on laboratory work for seven limestones were compared with the pilot plant experimental results of Pope, Evans and Robbins, Argonne National Laboratory, Consolidation Coal Co., and Morgantown Energy Research Center, agreement was good for all three methods.

5823 Investigation of the application of the bio-oxidation process to neutralize the excess activated sludge from an industrial installation for coking plant effluent treatment. Olczak, C.; Wolany, B. *Koks, Smola, Gaz;* **22**: No. 1, 13-17(Jan 1977).

Results of tests of aerobic digestion of excess sludge resulting from coking plant effluent treatment are presented. Tests carried out with an increased aeration rate have shown this to be unsuitable; the sludge was subject only to a small degree of mineralization, while its capacity for self-dewatering was decreased.

5824 Unique water purification system for ERPM. *Coal, Gold Base Miner. South. Afr.;* **24**: No. 12, 22-23(Dec 1976).

A pumping system has been installed at East Rand Proprietary Mines Ltd. which is capable of handling all the water from the Central Witwatersrand compartment. Its capacity is 45.4 ML/day and details of the plant are given. Water treatment is by the HDS line process which is operated under license from Bethlehem Steel Corp. The acid waters treated by the plant contain a high proportion of precipitable solids. The water is discharged to a stream, and regulations require that such waters have a pH between 5.5 and 9.5, less than 25 mg/l suspended solids and less than 7 mg/l iron in solution.

5825 Water treatment and supply at coking plant ancillaries. Shapoval, Yu.G. *Koks Khim.;* No. 9, 54-57(Sep 1976).

The main aim is to provide a closed cycle without effluents. Despite the adoption of dry quenching, the additional sludge load has been accommodated and the clarified water now forms part of the general circuit. Phenol liquors still present a problem, due partly to the absence of clearly established standards. Bio-chemical treatment plants are at present being revised and re-assessed in Giprokoks. A total-usage effluent treatment facility is being installed at Avdeev coke works. Two stages of bio-chemical treatment are involved with biological purification, in conjunction with municipal clarification systems. There will be additional biological treatment and clarification in lagoons and the resulting water will be returned to the plant in part, and partly used for irrigation. Chlorinating and cuprocyaniding facilities are available to handle encrustation problems in cooling towers and pipe mains.

5826 Disposal of coal-fired utility wastes. Roffmann, H. *Ind. Wastes (Chicago);* **22**: No. 5, 36-39(1976).

In the US the coal used for power generation now creates 50 m ton/year of wastes in the form of fly and bottom ash, scrubber residues and coal preparation wastes. These will increase with the decreasing availability of other fossil fuels and the proliferation of coal gasification and liquefaction plants. The degradation of surface waters and groundwater aquifers is the major concern associated with the disposal of these wastes. The effects can be greatly reduced by proper siting and effective design of disposal areas.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 5794, 5797, 5885, 6954, 7380, 7381, 7382, 7430, 7435, 7437, 7513, 7565

5827 (ARP—37) **Environmental regulation and the allocation of coal: a regional analysis.** Schlottmann, A.M. (Tennessee Univ., Knoxville (USA). Appalachian Resources Project). Aug 1975. 286p. of Tennessee, Appalachian Resources Project, Knoxville.

Thesis. Submitted to Washington Univ., St. Louis, MO.

The effects of sulfur content of coal, location of coal deposits, air pollution standards, availability of water, land reclamation regulations, possible pollution taxes, etc. are used in a linear programming computer model to predict the effect of various scenarios on regional coal production, transport of coal, regional environmental effects, and the prospects of coal mining in several regions, etc. (LTN)

5828 (BNWL—2224) **Characterization of substances in products, effluents and wastes from synthetic fuel development processes. Quarterly report, fourth quarter 1976.** Fruchter, J.S.; Petersen, M.R.; Ryan, P.W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jan 1977. Contract EY-76-C-06-1830. 15p. Dep. NTIS, PC A02/MF A01.

Pacific Northwest Laboratories is working under contract with the Energy Research and Development Administration to characterize materials from promising synthetic fossil fuel processes. The objectives of this program are to identify and quantify the constituents occurring in products, effluents, and emissions from the technology processes that warrant consideration in the development of control measures. A part of our program includes the collection, characterization, preservation, and storage of products, effluents, and wastes from these processes. These materials may then serve as research materials for more detailed characterization and for environmental and health effects studies. An important purpose served by the research materials is to permit laboratories to compare their results when carrying out various tests and studies with the materials. The program thus provides an essential element of quality control and validation of procedures to the health and environmental studies conducted by the laboratories. These quarterly reports are intended to provide up-to-date information on the status of these characterization efforts to those concerned with emission control and to the biological and environmental scientists working in this area.

5829 (CONF-7609125—, pp 18p, Paper 14) **Water demand related to increased coal utilization in the United States.** Kilpatrick, F.A.; Davis, G.H. (Geological Survey, Reston, VA). 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

National energy policy in the United States calls for replacing imported petroleum with fuels derived from the plentiful domestic coal and oil shale resources, with due regard for environmental and economic considerations. Much of the extraction of the coal in the Western United States is by surface mining and the water required for reclamation depends on the particular topography, climate, and rainfall distribution of each coal field in this large semiarid region. Significant progress toward limiting petroleum imports will require not only replacing gas and oil with coal as a source of industrial energy, but also will require major development of synthetic gas from coal for home and commercial heating. Ironically, the most desirable coals for synthetic gas production are found in semiarid parts of the United States where the limited water supplies have been largely allocated to other uses. This is a severe constraint on mine-mouth conversion plants in water-deficient areas. Some alternatives under consideration to reduce water demand in water-deficient areas are greater reliance on direct burning of coal, location of conversion plants where water is plentiful with coal transport by rail or slurry pipelines, and reduction in the water demand of conversion plants by maximum reliance on air cooling in place of wet cooling towers.

5830 (CONF-7609125—) **Proceedings of the international symposium on fossil fuel production and water resources.** (Deutscher Verband fuer Wasserwirtschaft e.V., Essen (Germany, F.R.)). 1976. 470p. (In German and English). Dep. NTIS (US Sales Only), PC A20/MF A01.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

The Symposium Water Economy and Management and the Recovery of Fossil Fuels was held at Dusseldorf, German Federal Republic on September 7-8, 1976. The papers deal mainly with water management problems related to surface and underground coal mining in the western area of the German Federal Republic. A few papers deal with other areas and other fuels. Twenty-seven papers have been entered individually into EDB and ERA. (LTN)

5831 (CONF-7609125—, pp 16p, Paper 3) **Water-management and hydraulic engineering in the Rheinisch-Westfaelisch coal mining region.** Annen, G. (Emschergenossenschaft and Lippeverband, Essen). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The Rheinisch-Westfalische coal mining--also called Ruhr coal mining--occurs mainly underneath the Emscher and Lippe river areas, partly also on the left-hand side of the river Rhine. The mining activity induces subsidence of the surface above the mining fields, which in some places have reached 15 m or more. The streams in the area described have only little natural slope. Therefore the flow of water is disturbed by subsidence again and again. This proves to be disadvantageous, especially because industry and population are concentrated in this area. The flooding of subsided areas must be prevented. This is possible only by large area planning of water engineering. Communities, coal mining and industry therefore in 1904 established the Emschergenossenschaft (Emscher Water Association). The objects of the association are to regulate water flow and to treat the sewage. The costs of the activities are raised by the members, taking into consideration, the damage a member causes and the advantage he gets by the activity of the association. The Emschergenossenschaft has been the model for further associations being founded in other coal mining areas: The Lineg (Left Rhenish Draining Association, 1913) and the Lippeverband (Lippe Association, 1926). Some of the principle tasks of the associations are described.

5832 (CONF-7609125—, pp 16p, Paper 4) **Hydrologic effects of strip mining in the Busseron Creek watershed.** Beaumont, J.A. (Harza Engineering Co., Chicago); Wetzel, A.J. 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The Busseron Creek Watershed is located in southwestern Indiana. The drainage area is 239 square miles. Strip mining has been conducted in the basin since 1917, and at present about 10 percent of the area has been disturbed. In 1966 a series of automatic stream gages and precipitation gages were installed to provide runoff data for several parts of the watershed. These data are the basis of this discussion of the hydrologic effects of strip mining in the Busseron Creek Watershed. Records from tributary watersheds with and without strip mining were analysed and compared. Analyses include estimation of unit-area runoff by months, comparison of daily flow duration curves and flood frequency curves, and estimation of lag times of runoff during major storms in 1968, 1969, and 1970. The conclusions are that for drainage basins with large amounts of strip mine activity: (1) flood peaks are significantly reduced by the lengthening of time of concentration and reduction of the contributing drainage areas; and (2) the extreme low flow was increased 10 to 40 percent. In addition there is no identifiable effect on runoff from areas with only a small percentage of the area disturbed.

5833 (CONF-7609125—, pp 22p, Paper 5) **Hybrid computer model to forecast groundwater drawdown in the surface mining of brown coal.** Billib, H; Hoffmann, B.; Fredrich, H.J.; Klenke, M. (Technische Univ., Hanover). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

Connected with the surface mining of brown coal in the Erft basin is groundwater drawdown and recharge. A forecast of the resulting groundwater flow conditions and their optimization in temporary and local distribution is necessary. Together with data from surface hydrology, the result of such a forecast can be used for setting up long-term water management plans. A computer model developed previously is used for simultaing groundwater flow in the Erft basin. Simulation models have been used effectively for the determination of flow conditions in aquifers in the case of recharge for supply with groundwater. In the present case however, some important changes had to be made in the development of the model. Emptying of all aquifers down to the coal has to be simulated. The physical conditions in all aquifers have to be taken into consideration simultaneously to include interacting effects between them. Different mathematical formulations for various flow conditions have to be set up and tied together. The results are interactions and nonlinearities. As the processes are unsteady state, the set of describing equations is very complex. A digital solution would need an unusually large capacity of computer storage and would probably lead to uneconomical computing times. For this reason a hybrid computer was chosen for the solution of the system of differential equations. The combination of a digital and an analog computer has the following advantages: Continuous simulation of time dependent function in

case of unsteady groundwater flow; simulation of nonlinearities and feedback by analog hardware; and simultaneous solution of the describing equations at several nodes of a grid. The development and possibilities for the use of the model are presented.

5834 (CONF-7609125—, pp 11p, Paper 10) **Strip mining: an important element of river basin management.** Day, H.J. (Univ. of Wisconsin, Green Bay). 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The impact of surface mining on the local and regional watersheds in two distinctively separate regions of the United States, the water-abundant East and the arid or semi-arid West, is reviewed. Changes in water resources are reported in both regions as a result of strip mining, but land rehabilitation is more rapid in the East than in the West where new mines are expected to open in the years ahead. Rehabilitation potential is reported to be increasingly important as a factor to be considered in mine site selection in the West. The use of remote sensing, satellite-based systems for watershed management is reported. Application of this technology to river basin management associated with surface mines is proposed. Approximate costs associated with its use are provided.

5835 (CONF-7609125—, pp 22p, Paper 16) **Water resources management and deep opencast mining on lignites in the Erft-district.** Lindner, W.; Stein, A. 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

In the Western part of the German Federal Republic a large brown coal deposit is developed by deep strip mining. At present the strip mines are operated at a depth of up to 300 m (220 m below sea surface); a new mine will be developed reaching to a depth of up to 500 m. In order to mine the lignites, the groundwater level has to be lowered below the coal mining levels. Over 1 Bill. m^3 of groundwater are pumped each year. The groundwater lowering affects the upper aquifer in an area of about 1,100 km^2 and the lower ones for more then 2,000 km^2. The pumped groundwater is partly used for municipal water supply, the major part though is discharged into watercourses by means of special water works. This groundwater drainage and discharge is a major interference in the groundwater resources of a large region. By a special statute an association under public law was established (The Grater Erft Association) and assigned the complete water resources management in an 2,700 km^2 large area: To study and observe water resource conditions; to satisfy water demands; to eliminate harmful effects of waste water; and to maintain and improve the quality of the receiving watercourse. The report deals with the business of the association, particularly with groundwater exploration and observation (quantity and quality) and with measurements to satisfy water demands. The excavated strip mines have to be revegetated to agricultural lands and forests or used for water resources management. Due to the volume deficit depressions will remain which are to be developed to lakes. In the middle of the next century a lake with a capacity of about 2,5 Bill. m^3 is expected to be operated after filling it with water from the Rhine River which is located at a distance of 20 to 30 km from the strip mines.

5836 (CONF-7609125—, pp 20p, Paper 17) **Principles for the planning and design of drainage pumping stations in areas of mining subsidence.** Londong, D. (Emscher and Lippe Associations, Essen). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The subsidence of the earth's surface as a result of the mining of underground coal necessitates the widespread use of drainage pumping stations in the area of the Emscher and Lippe Associations to regulate the water flow. There are at present 111 pumping stations in operation with a maximum capacity of altogether 470 m^3/s and an installed rating of 94,5 MW. Together they drain an area of 450 km^2 by both continuously pumping untreated waste water as well as carrying off flood water on the rare occasions of heavy rainfall. The planning and design principles of the pumping stations are based on the experience of the Associations stretching back to the turn of the century. New knowledge and the progress of technology have demanded constant re-examination and further development. In so doing, the requirement which always applied was that, in view of the high-quality use to which the catchment area was put, the planning, construction and operation of the pumping stations have to be geared to a particularly high level of safety without incurring unjustifiably high costs. Since the planning has to be founded on subsidence prognoses which are uncertain in view of rapid changes in the planning of coal workings, flexibility in planning and design is a necessity. It has to be possible, therefore, to raise the pumping head within certain limits at a later date if the catchment area becomes increasingly developed or if it is enlarged as a result of additional subsidence. The pumps should be rugged and insensitive to clogging. For reasons of economy the pumps are electrically driven. To ensure a reliable energy supply, it is best to provide several, independent feeds. The aim is to have fully automatic pumping with remote monitoring from a few operating centers. In this way personnel costs are considerably reduced. Foundation design is determined by the requirement for safety against uplift and by the loads resulting from soil movements.

5837 (CONF-7609125—, pp 6p, Paper 18) **Influence of ground subsidence due to mining on river regime and scale model experiments.** Mosonyi, E. (Univ., Karlsruhe, Ger.). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

Subsidence due to coal mining may influence the regime of the rivers crossing valleys in mining areas. Two examples are described here. The first case refers to a mining scheme that has been carried out in such a way that a predicted settlement of river harbours and locks could be achieved in order to counterbalance the progressing erosion of the Rhine River, which jeopardized safe navigation over the lock sills and into the harbour bays at the Ruhrorter Hafen. The second example refers to a scale model study carried out under the guidance of the author in the Theodor-Rehbock-Hydraulic Laboratory. The objective of these experiments was to observe and measure on a physical model the consequences to be expected of a mining project along a valley stretch of the Ruhr River. Among others the main questions were: Change of water level profiles and influence of subsidence on sediment transport. Model topography has been simulated according to the subsidence (iso-lines) plan based on precalculated data of the mining company.

5838 (CONF-7609125—, pp 24p, Paper 22) **Coal mining and water economy in the Ruhr.** Ruerup, H. (Ruhrkohle Aktiengesellschaft, Essen). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

Up to date, the extraction of coal from underground has amounted to a removal of about 8000 million cubic meters and resulted in large subsidence troughs at the surface. For the winning of water, the discharge of waste waters and effluents and the safety of inland waterways in the zone of influence of coal mining the question of the advance calculation of the subsidences to be expected due to mining is of essential importance. This task can be solved today by means of electronically controlled computers and drawing devices. Various examples show how important it is to comprehend in good time and as fully as possible the conception of coal mining underground on the one hand and the building-technical requirements and possibilities at the surface including the cost required therefore, on the other. Only then will it be possible to coordinate interests and solve any difficulties in a technically and economically optimum way. The interests of water economy and the production of fossil energy do not exclude each other. An orderly co-existence is possible and necessary at least under the prevailing conditions in the Ruhr District.

5839 (CONF-7609125—, pp 12p, Paper 24) **Rehabilitation of exploited strip mining fields using excess water from floods.** Scheuerlein, H. (Technische Univ., Munich). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The rehabilitation of exploited strip mining fields is becoming increasingly difficult in Germany due to tight environmental regulations. For more than one reason the conversion of exploited strip mining fields into artificial lakes is an attractive idea and the utilization of excess water from floods for its implementation has additional advantages. However, the practical realization of this idea is hindered by several technical problems due to unfavourable conditions as: High discharges (flood peaks); steep and highly erodible slopes; large depth of strip mining fields, resulting in high velocity; and low or missing back-water. In spite of these rather unfavourable conditions two alternative solutions of a diversion structure have been designed and studied in a 1:6 scale model on the strip mining fields of the Bayerische Braunkohle Industrie AG in Schwandorf. The main characteristics of the two alternative chute designs were flexible structures capable of following changes in the foundation to a

certain extent. The ends of the two chutes were designed as flip-buckets. Extensive model tests have been carried out to prove the general capability of the design. A prototype of the steel design is under construction.

5840 (CONF-7609125—, pp 20p, Paper 27) **Some special problems of constructing dikes in subsiding area.** Stalmann, V. (Emschergenossenschaft, Essen). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

In the catchment area of the Emscher, having poor natural slope coal mining causes locally limited subsidence of the surface which affects the water flow of streams. Dikes along the streams prevent formation of a lake in the depression and permit the stream to flow above the surface. Since mining activities will occur in the same field repeatedly, constructing dikes once does not end the task. The dikes have to be adapted to the development. According to computer forecasts of the depth of subsidence they are being elevated. Modern methods of mining make this task more and more difficult. The exceptionally large need of construction materials for dikes having heights of 15 m and protecting 90 km of watercourses in the Emscher-area is being covered by washery refuse, a by-product of coal mining. To make the dike impervious a special sealing, for instance, by a sand layer or slag of the Siemens-Martin steel production process has to be provided. A special storm water emergency service has been organized for public security.

5841 (CONF-7609125—, pp 17p, Paper 28) **Coal-resource development alternatives, residuals management, and impacts on the water resources of the Yampa River Basin, Colorado and Wyoming.** Steele, T.D. (Geological Survey, Lakewood, CO). 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

Development of coal resources in the Yampa River basin in the southern Rocky Mountains of the United States will have a variety of effects on available water resources. These involve both direct effects caused by coal extraction, processing, transport, and conversion techniques utilized or proposed for the region and also indirect effects associated with regional economic growth. Impacts from both types of effects involve water resources of the basin in terms of water withdrawals, consumptive use, and assimilative capacities of discharged residuals (that is, noneconomic by-products). A regional residuals management analysis involves assessing mass and energy balances of the primary economic activities, as well as an economic and technical evaluation of alternative strategies of treatment and modification of residuals discharged to the environment from various sources. Constraints on viable alternatives include considerations of (1) capital and operating costs of facilities, (2) treatment technologies, (3) water rights, and (4) environmental standards. Approaches and results to date of residuals management and environmental modeling techniques for evaluating water resources impacts of coal-related development in the Yampa River basin, Colorado and Wyoming are described.

5842 (ERDA—77-64, pp 7-19) **Characterization and analysis.** Cunningham, P.T.; Abel, K.H.; Bosshart, R.E. Jun 1977.

In Effects of trace contaminants from coal combustion.

Determination of adverse ecological or health effects of coal-derived trace contaminants is dependent upon characterization, that is, a complete chemical and physical description of materials entering the environment from these systems. The Characterization and Analysis Panel attempted to identify current capabilities in this area and to focus on those problems that still prevent adequate characterization. The report of this Panel is organized into two sections, addressing first the current state of technology followed by a section detailing our recommendations on needed research. For clarity these sections are further divided into subsections on sampling, analysis and instrumentation, standard materials and methods, and characterization studies.

5843 (ERDA—77-64, pp 41-56) **Ecological effects.** Jones, H.C.; Andren, A.W.; Buffington, J.D. Jun 1977.

In Effects of trace contaminants from coal combustion.

The Ecological Effects Panel placed trace contaminants from coal combustion processes into three categories: trace elements, organics, and radionuclides. These contaminants enter the environment through the atmosphere or land surfaces (discharge, seepage, and leaching into surface and groundwaters from coal storage, ash, and slag disposal areas) or ash disposal ponds. The Panel had insufficient information on the nature of the source term to adequately address the state-of-the-art or to make recommendations for research needs related to the ecological effects of trace organics or radionuclides. Thus, the panel restricted its deliberations to the trace elements from coal combustion. Even here discussions were limited by the paucity of information relative to amounts emitted during coal combustion, physicochemical characteristics, transport and rate of deposition, and movement, availability, and dose-response relationships in either aquatic or terrestrial ecosystems.

5844 (ORNL/Sub—4484/2) **Evaluation of pollution and water consumption.** (United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)). Feb 1976. Contract W-7405-ENG-26-7405-ENG-4484. 86p. (UEC-UCC—760227). Dep. NTIS, PC A05/MF A01.

All of the coal conversion processes reviewed in this report discharge pollutants to the environment. The composition and quantity of these pollutants depend primarily upon the individual process design and properties of the coal feed. A table shows the processes selected for review, the development stage of each process, and the coal feed used as a basis. All the processes meet existing federal regulations limiting pollutant emissions. A summary is presented of the major pollution outputs from each process and the water usage expressed in pounds per million Btu's of product (lb/10^6 Btu.) In this manner, those processes within the same product group can be compared on an equivalent basis. A table summarizes the major pollution outputs and water usage of each process expressed in pounds per ton of coal feed. The sources of pollutants and pollution control methods for the selected coal conversion processes are shown in a table. A brief overview of the pollutants from each process is given below. A brief description of processes which remove pollutants is included.

5845 **Coarse discard from mines.** Bell, F.G. *Civ. Eng. (London);* 37-39(Mar 1977).

The mineralogical and geotechnical properties of coal pit-heap materials and its weathering are discussed.

5846 **Derelict site rejuvenated for industry.** *Surveyor (N.Y.);* **149**: No. 4419, 15(Feb 1977).

Brief information is given about the Parkhouse industrial estate at Newcastle-under Lyne. The estate is being developed on land which was formerly occupied by collieries, spoil tips, brick kilns and disused marl pits.

5847 **Detection of Thiobacillus Ferrooxidans in acid mine environments by indirect fluorescent antibody staining.** Apeland, W.A. *Appl. Environ. Microbiol.;* **32**: No. 1, 159-165(Jul 1976).

An indirect fluorescent antibody (FA) staining technique was developed for the rapid detection of Thiobacillus Ferroxidans. The specificity of the stain was demonstrated with both laboratory and environmental samples. Coal refuse examined by scanning electron microscopy exhibited a rough, porous surface, which was characteristically covered by water-soluble crystals. Significant numbers of Thiobacillus Ferrooxidans were detected on the exterior refuse surface by FA staining, whereas none were detected in the refuse pores. A positive correlation between numbers of Thiobacillus Ferrooxidans and acid production in coal refuse in the laboratory was demonstrated with the FA technique.

5848 **Water and atmospheric environmental protection for coking plants.** Privalov, V.E. *Koks Khim.;* No. 6, 53-56(Jun 1976).

This paper considers the basic effluents and emissions from coking plants which exert a toxic effect and need to be neutralized or eliminated. All areas of the plants are involved, including use of effluents for wet-quenching of the coke, smokeless charging and deep-level scrubbing of the gas. Emissions can be reduced by storing coal in closed silos. All coal and coke carrying equipment should be shrouded and, if possible, totally enclosed. Changing to dry quenching appears to reduce the emission factor. Machines have been developed for cleaning the oven tops and automatic scrubbers have been installed in the quench-tower offtakes. The utilization of tailings for building materials and road ballast is mentioned. The need for total recovery of combustibles and chemicals from the tailings is stressed. A final note relates to biochemical effluent cleaning operations and these should be virtually universal by 1980.

RESERVES AND EXPLORATION

REFER ALSO TO CITATION(S) 5795, 5860, 5882, 5916, 6886

5849 (BM-RI—8226R) **Geology and methane content of the Upper Freeport coalbed in Fayette County, Pa.** Steidl, P.F. (Bureau of Mines, Pittsburgh, Pa. (USA). Pittsburgh Mining and Safety Research Center). 1977. 21p. of Mines, Washington, DC.

As part of the Bureau of Mines methane control program, the Upper Freeport coalbed was studied in Fayette County, Pa., where this coalbed lies about 650 feet below the Pittsburgh coalbed and contains the largest remaining reserves of any coalbed in the county. Coal and overburden isopachs, structure and joint pattern maps, and a fence diagram were prepared using data from gas and oil exploration logs and coal outcrops. These maps will aid in determining the

need and/or feasibility of degasifying the Upper Freeport coalbed in the study area. Much of the coalbed in this area is under 600 to 1400 feet of overburden. By correlation with data from the Pittsburgh coalbed, the gas content at depths of this order is estimated to be between 140 to 300 cf/ton of coal, for a total of 190 to 400 billion cubic feet of methane in this coalbed in Fayette County.

5850 (BM-RI—8247) **Geology and gas content of coalbeds in vicinity of Bureau of Mines, Bruceton, Pa.** Elder, C.H.; Irani, M.C. (Bureau of Mines, Pittsburgh, Pa. (USA). Pittsburgh Mining and Safety Research Center). 1977. 26p. of Mines, Washington, DC.

Two degasification test boreholes were drilled to depths of 1238 and 1212 feet on Bureau of Mines property at Bruceton, Pa., as part of the Bureau's long-range coal degasification program. The holes provided detailed geologic information and geologic sections, which were correlated with regional stratigraphic cross sections prepared by the Pennsylvania Geological Survey. Gas content determinations and coal analyses were made on the Upper Freeport, Middle Kittanning, Clarion, Brookville, and Mercer coalbeds; gas content of the coalbeds ranged from 53 to 165 cubic feet per ton. Formation pressure and gas flow tests were conducted on selected coalbed intervals in borehole 1; formation pressures ranged from 292 to 473 psig. The middle Kittanning coalbed was hydraulically stimulated using very heavy gelled water, but gas production remained low because gel residue and formation water inhibited the flow of gas. Gas contents in the Clarion, Upper Brookville, and Mercer coalbeds were anomalously low owing to the proximity of porous sandstones which act as reservoirs for gas migrating from coalbeds.

5851 **Type section of the Teapot sandstone.** Curry, W.H. III. pp 29-32 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

An outcrop of the Teapot sandstone on the point of a hill southwest of Teapot Rock in T38N R79W, Section 27, SW¼SW¼SE¼, Natrona County, Wyoming is described. The reference outcrop is west of the highway and Teapot Ranch. The Teapot sandstone was first mapped around Salt Creek oilfield by C.H. Wegemann in 1911 and named Little Pine Ridge sandstone (USGS Bulletin 452, p. 48). In 1913 V.H. Barnett renamed the sandstone Teapot sandstone from the "Teapot Rock," a well-known topographic feature carved from this sandstone about half a mile east of the Casper-Salt Creek road. Barnett used the new Teapot member to include both marine and non-marine sandstones between Casper and Glenrock. Further, the basal sandstones of Teapot Rock are marine and contain Ophiomorpha, therefore, the term Teapot sandstone should continue to follow Barnett's original usage to include both marine and non-marine sandstones, coals, and other associated lithologies in this stratigraphic interval.

5852 **In-situ mineral deposit evaluation with the metalog system.** Nargolwalla, S.; Seigel, H.O. (Nucl Appl Res Lab). *Can. Min. J.;* **98**: No. 4, between p 75 and 89(Apr 1977).

The radiative neutron capture process appears to be the most promising one for the in situ determination of certain elements surrounding boreholes. This paper describes the application of the prompt gamma-ray analysis technique to lateritic nickel and porphyry copper orebodies for the simultaneous determination of nickel, iron and silicon in a lateritic medium and copper, iron and silicon in a porphyry matrix, and seam determination and sulphur content within the seams in a coal deposit. The descriptive name by which Scintrex has designated this technique is "Metalog." 6 refs.

5853 **Simplified method of graphically depicting the type of cracking of rocks.** Yatsuk, V.I.; Lopukha, V.P. *Razved. Okhr. Nedr;* No. 4, 30-33(Apr 1977). (In Russian).

A new simplified method of graphically depicting the type of cracking of coal beds and enclosing rocks is proposed which makes it possible to determine both the elements of occurrence of the cracks (trend and dip directions and dip angle) and the crack repetition frequency.

5854 **Types of peat beds serving as a basis for the formation of coal beds.** Lapo, A.V. (All-Union Sci-Res Geol Inst, USSR). *Solid Fuel Chem. (USSR) (Engl. Transl.);* **10**: No. 3, 57-62(1977).

In a development of the ideas of I.A. Titov and N.M. Karavaev, it is proposed to reconstruct the evolution of the coal-forming paleoecosystems by investigating the distribution of nitrogen in the coal beds. The coal beds most suitable for this purpose are those with a high content of vitrinite changing little over the section of the bed. As the study of coals of equal age from the Donetsk, Kuznetsk, Kansk-Achinsk, southern yakutsk, and Lensk basins and some coal deposits of the Ukraine, Kazakhstan, and Chukota has shown, the passage from eutrophic paleoecosystems to oligotrophic systems must be regarded as one of the variants of their ontogenesis. 41 refs.

5855 **Electromagnetic modeling of reflections inside an in situ gasified coal seam.** Holmes, J.J.; Balanis, C.A. (West Virginia Univ., Morgantown). *Radio Sci.;* **12**: No. 1, 33-40(1977).

As an aid in the design of an electromagnetic system for the detection, monitoring, and mapping of the burn front of an underground (in situ) coal gasification process, an analytical model has been developed that will predict the electromagnetic field reflected from the gasified portion of the coal seam. The coal and gasified section have been modeled electrically as lossy media, surrounded above and below by relatively high conducting overburden and underburden. Vertical and horizontal electric and magnetic dipoles have been investigated, utilizing a geometrical optics formulation which also takes into account the physical roughness of the coal-overburden (underburden) and coal-gasified section boundaries. Indications are that a swept frequency monitoring system is capable of locating the burn front of the in situ gasification process, with the vertical electric dipole being the most attractive element.

5856 **Pollen changes near the Fort Union-Wasatch boundary, Powder River Basin.** Tschudy, R.H. (Geological Survey, Denver). pp 73-81 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Results are presented of palynological work which was initiated in an attempt to find out whether or not consistent recognizable pollen changes are present in the interval of rocks between Smith coal bed and the Felix coal bed. The palynological data obtained from the Golden Valley Formation of western North Dakota, from the Burgess coal zone Homogalax locality, and from the vicinity of Delson's (1971) early Eocene vertebrate quarries, indicates that the entrance level of Platycarya group pollen flora (zone Z) coincides closely with the first occurrence of early Eocene vertebrate fossils. Furthermore, both the vertebrate and palynological data indicate that in at least part of the Powder River Basin, and floral and faunal change does not coincide with the Fort Union-Wasatch formational contact. The floral change between zone X assemblages and zone Y assemblages is a somewhat gradual one and at some places may be obscured by local variations in the regional flora. On the other hand, the floral change from zone Y assemblages to zone Z assemblages is comparatively abrupt and readily recognizable. The flora obtained from zone Y assemblages shows a much greater degree of similarity to zone X assemblages than to those of zone Z. The evidence presented suggests that the palynological Paleocene-Eocene boundary in the Powder River Basin can be reasonably defined by the entrance level of the Platycarya group pollen flora. (JRD)

5857 **Coal in the Wasatch Formation, northwest part of the Powder River Basin near Sheridan, Sheridan County, Wyoming.** Culbertson, W.C.; Mapel, W.J. (Geological Survey, Denver). pp 193-201 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Results are presented of geologic mapping and coal resource evaluation done in 1973 and 1974 by the U.S. Geological Survey in seven 7½-minute quadrangles, encompassing an area of 380 square miles between Sheridan on the west and the small town of Clearmont on the southeast. The resource evaluations are based mostly on coal thicknesses determined by measurements at outcrops. Coal thicknesses of the thicker beds were determined at 23 localities from gamma ray logs of holes drilled with a power auger. Geologic maps, coal sections, analyses, and resource information are published for six of the seven quadrangles including Wyarno (Culbertson 1975)), Jones Draw (Culbertson and Klett, 1975a), SR Springs (Culbertson and Klett, 1975b), Bar N Draw (Mapel, 1976), Ulm (Mapel and Dean, 1976a) and Verona (Mapel and Dean, 1976b). A report on the remaining quadrangle, the Buffalo Run Creek quadrangle (Mapel and Malahy), is in press.

5858 **Update on the Powder River Coal Basin.** Glass, G.B. (Geological Survey, Casper, WY). pp 209-220 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Although coals are reported in the Upper Cretaceous Mesaverde and Lance Formations, the thickest and most important coals are limited to the Paleocene Fort Union Formation and the Eocene Wasatch Formation. Since Berryhill, et. al.'s (1950) original resource estimates, the U.S. Geological Survey has estimated another 500 billion tons of undiscovered resources underlie the Powder River Basin. These hypothetical and speculative resources, however, will

soon move into the identified category as numerous maps and reports of the U.S. Geological Survey are published. All these estimated resources are for subbituminous coal since there are no resource estimates of the lignite in the northeastern corner of the basin. The Powder River Basin's remaining identified resources are estimated at 110 billion tons (modified from Berryhill, et. al., 1950). This figure is more than 80 percent of the total remaining identified coal resources in Wyoming. Additionally, more than 63 percent of the Powder River Basin's remaining resources are located in Campbell County. All these identified resources include coals 2.5 feet and thicker, in measured, indicated and inferred categories between 0-3000 feet of cover. The U.S. Bureau of Mines recently estimated that the remaining coal reserve base in the Powder River Basin was approximately 43.9 billion tons on January 1, 1974 (Hamilton, et. al., 1975). They estimated 21.3 billion tons are recoverable by strip mining methods; 22.6 billion tons are recoverable by underground mining methods. Collectively, these reserves are equivalent to 82 percent of the known remaining coal reserve base in Wyoming, which is estimated at 53.3 billion tons. It should also be mentioned that these reserve figures are very conservative and may be off by several orders of magnitude.

5859 Large-scale compaction structures in the coal-bearing Fort Union and Wasatch Formations, northeast Powder River Basin, Wyoming. Law, B.E. (Geological Survey, Denver). pp 221-229 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Coal investigations in the Powder River Basin, Wyoming, disclosed several areas of anomalous folding near Gillette. Until recently, the relation of lithology to folding could not be determined because exposures are poor and(or) the rocks are intensely altered owing to burning of the coal beds. The probable environment of deposition is related to compaction folding and evidence is presented which suggests that the folding was penecontemporaneous. As a result of the surface and subsurface investigations in the Rawhide Creek area, it is concluded that many of the surface folds in the Gillette, Wyoming, area are compaction folds. Facies changes in the coal and noncoal lithologies suggest that differential compaction is a response to specific environments of deposition and that the folding is penecontemporaneous. The magnitude of the folds has been intensified by the unusually thick Wyodak coal. In coal-bearing rocks where the coal beds are not as thick, the resulting folds may not be as large. (JRD)

MINING

REFER ALSO TO CITATION(S) 5792, 5793, 5827, 5830, 5833, 5835, 5836, 5837, 5838, 5839, 5840, 5841, 5882

5860 (BM-RI—8241) **Water infusion of coalbeds for methane and dust control.** Cervik, J.; Sainato, A.; Deul, M. (Bureau of Mines, Pittsburgh, Pa. (USA). Pittsburgh Mining and Safety Research Center). 1977. 32p. of Mines, Washington, DC.

This Bureau of Mines report deals with water infusion of coalbeds, which can control methane emission at face areas during developmental mining and which may sometimes suppress dust. Studies show that water infused into the coalbed flows through the fracture system and displaces the methane in the fractures and prevents migration from the solid coal. Displaced gas migrates away from the face area that has been water infused and enters the return ventilation airways. A gradual decrease in methane emission is observed from the start of infusion until the infused zone is mined through. Depending on the permeability of the coalbed, infusion pressures ranged from 300 to 2200 lb/in^2. Face emissions in the Upper Kittanning coalbed were reduced by 89%; reductions of 38 to 79% were measured in the Pittsburgh coalbed depending on the relationship between the face cleat direction and mining direction. Respirable dust levels were reduced by about 75% on a longwall section in the Pocahontas No. 3 coalbed and by about 50% on a development section in the Upper Kittanning coalbed, but no statistically reliable reduction was found in the respirable dust levels in the Pittsburgh coalbed.

5861 Hydrologic factors related to coal development in the eastern Powder River Basin. Davis, R.W. pp 203-207 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Some of the patterns and controls related to ground water movement and ground water quality that are beginning to emerge from Powder River Basin studies which have been conducted are outlined. The vehicle for presenting the ideas will be a discussion of classification schemes followed by a discussion of hydrologic systems. The data indicate that most of the eastern Powder River Basin is a recharge area for the ground water system below the Wasatch formation. Water within this system probably ultimately drains into the Tongue River which is a perennial stream, depending upon that ground water source for its base flow. The fact that the eastern Powder River Basin is a recharge area also indicates why there are no perennial streams in the area of the coal outcrop. Along the coal outcrop, chemical quality of the water is generally of a calcium-magnesium sulfate type changing to a sodium bicarbonate type westward where confined aquifer conditions exist. Along the line between the two water types where confined conditions begin, transmissivities in the coal can be very low because of gypsum and epsomite filling the fractures. The scoria appears to be a very important area of recharge to the coal aquifers. The stream valleys may also provide recharge at points where alluvium and coal are in contact. There seems to be little or no relationship between water levels in the Wasatch formation and in the coal except that those in the Wasatch formation are invariably higher than those in the coal. Research at this point has not progressed much beyond the stage of being able to predict what ground water conditions are in the undisturbed, unmined material. What the effect of reclamation will be upon water quality and quantity is still very hypothetical. The variations in water quality ennumerated here and linked to variations in hydrostatic stress indicate some lines of research which might provide very useful insights.

5862 (CONF-7609125—, pp 20p, Paper 6) **Dewatering with large-bore tube wells and submersible pumps.** Blank, R. (Rheinische Braunkohlenwerke AG, Cologne). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The dewatering of open cast mines of the Rheinische Braunkohlenwerke AG Koln (Rheinbraun) is conducted by operating tube wells equipped with submersible pumps. The technology includes drilling properly designed, deep, large-diameter wells with gravel packs and discharging large volumes of groundwater. The wells are drilled applying the reverse circulation air injection method. Usually, the drilling fluid is pure water without any additives. The state of art and the advantages of this method as well as the equipment are described. A well having a depth of 500 m and a drilling diameter of 1,70 m takes only two weeks to be sunk, completed, and equipped with the pump. In addition, the paper deals with further developments of this drilling technique, well casings, screens, mechanical properties of pipe, pipe installation, corrosion resistance, etc. It is obvious that the diameter of the pump motor determines the inside diameter of the well; on the other hand, the size of the pump will always be limited by technical and economical conditions that prevent the drilling of wells with diameters of more than two meters. For these reasons a standardized series of submersible pumps had to be developed able to discharge the enormous volumes of water and to lower sufficiently the water tables in the water-bearing strata above and below the coal seams. Pumps with much larger rates of discharge and higher delivery heads than previously available are now on the market using high voltage motors at operating voltages of 10, 6, and 3 kV. Operational features such as the power supply of the well lines, the diversion of the discharged water, how it is made use of, etc. are outlined. So far, there have been only minor adverse environmental effects due to the large-scale ground water withdrawal.

5863 (CONF-7609125—, pp 20p, Paper 26) **Planning and calculation of the extensive ground water drawdown in the Rhine Basin lignite seams.** Siemon, H.; Voigt, R. (Rheinische Braunkohlenwerke AG, Cologne). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The lignite seams in the southern part of the lower Rhine Basin are bounded top and bottom by extensive water-bearing sand and gravel beds. To enable safe extraction of the coal from open pits it is necessary to dewater these aquifers. Dewatering is accomplished by means of large-diameter tube wells equipped with submersible turbine pumps. To compute the drawdowns to be achieved one-dimensional approximative methods are used that can roughly be subdivided into: (a) procedures to compute the spacing design and operational schedule of wells over the site of future open pit mines to remove the ground water from the top wall strata, or (b) procedures to calculate the drawdown using perimeter wells that are designed to

intercept the ground water flowing towards the open pits. This subdivision, making a distinction between the drawdowns inside and outside a mine, appears a rather schematic one. However, it enables us to determine the drawdown at any place at any time by using relatively simple approximations. The paper describes in a general manner the basic principles of both methods. For given hydrologic parameters, the number of dewatering wells and the time available can be varied to obtain a solution that is economically an optimum. A three-dimensional hybrid model of the multi-aquifer system Erft Basin is in construction to simulate how future dewatering will affect the remaining ground water resources in this part of the mining district. A digital two-dimensional model will be used to model the ground water withdrawal in virgin mining fields.

5864 (CONF-7609125—, pp 18p, Paper 11) **Optimal pumping for control of groundwater pressure in an open cast mine.** Elango, K.; Jothi Skankar, N.; Suresh Rao, H.; Sethuraman, V. (Indian Inst. of Tech., Madras). 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The problem investigated pertains to ground water control of a large open cast lignite mine. The lignite bed is underlain by a confined aquifer exerting high hydrostatic uplift on the lignite seam. Depressurization by large-scale pumping through wells was adopted fourteen years ago at the commencement of mining operations and has been continued with satisfactory results. The details of that part of the investigation dealing with the determination of the optimum pump-well disposition (subject to the mining and machinery constraints) are described. A mathematical model based on Thiem's steady state equation and the method of superposition is developed and formulated as a linear programming problem. The constraints include the desired drawdown levels at specified points along the axis of the mine, the minimum permissible levels of water in the pumping wells and the rated capacity of the pumps. Comparison of the results of the model for a particular period of pumping with the pumping pattern adopted in the field during the same period indicates that near-optimal pumpage has been achieved in practice through long experience. Furthermore the results of the model obtained for subsequent years are considered to be of great use in planning future water control operations during which geohydrological conditions are expected to be more severe.

5865 **Mine winder safety. Electronic protection system.** *Colliery Guardian;* **225**: No. 3, 138(1977).

The electronic microprocessor winder protection system installed at Cynheidre Colliery is described.

5866 **Hydrochloric acid injection as a means of gas removal.** Vasyuchkov, Yu.F. *Ugol;* **51**: No. 10, 55-58(Oct 1976).

An investigation of the injection of hydrochloric acid solution has been made. Concentrations between 2 and 4 percent were found to be ideal, but in any case the concentration should not exceed 10 percent. Graphs show the effect of rate of injection, the efficiency of penetration and the rate of reaction at different concentrations.

5867 **Development of geological structural criteria for predicting unstable mine roof rocks.** Hylbert, D.K. Knoxville, TN; Univ. of Tennessee (1976). 288p. University Microfilms Order No. 77-10,775. Thesis (Ph. D.).

A study designed to investigate the cause of roof falls in room-and-pillar coal mines and to determine geologic methods for predicting unstable roof conditions is presented. The study area was located in Harlan County, Kentucky and the Bailey Creek and Highsplint mines were selected for study. The Bailey Creek mine operates in the Harlan coal bed and the Highsplint mine operates in the Darby coal bed, about 200 feet higher stratigraphically. Both coal beds are in the Mingo Formation of the Breathitt Group of Pennsylvania age, deposited in a fluvio-deltaic environment. Studies at the Bailey Creek mine indicated that roof falls involving the main roof were related to cross-bedding in a sandstone channel. Failure was caused by the heading direction being driven subparallel to the channel direction and to the strike of cross-bedded sandstones filling the channel. Monitoring of the mine from April, 1976 to September, 1976 indicated improved conditions when the heading direction was changed to avoid both the channel direction and frequent joint directions. In the Highsplint mine roof falls are associated with zones of weakness within or between vertical cycles. These zones include rider coal seams, carbonized plant debris on bedding planes, thin-bedded brittle rocks, cross-bedding, and zones of poor sandstone cementation. (JRD)

TRANSPORT AND HANDLING

REFER ALSO TO CITATION(S) 5792, 5793

5868 **Exploration for ground water in the Madison Limestone, Niobrara County, Wyoming.** Anderson, K.E.; Kelly, J.E. pp 277-281 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Ground water for coal-slurry pipeline was investigated. Results suggest that (1) a recharge source exists close to the site, or (2) a very large area of the aquifer in the vicinity of the site has extremely high transmissivity that would act like a recharge source, or (3) significant vertical leakage or contribution to the Madison from adjacent strata occurs, or (4) some combination of these. It is concluded that the proposed coal-slurry project would not significantly affect water levels in existing Madison wells. (JRD)

5869 **Heavy duty primary screens for coal preparation plants.** Hampel, M. *Glueckauf;* **113**: No. 2, 80-85(Jan 1977).

Screens with a throughput in excess of 400 tonnes/hour which are used by Ruhrkohle are described.

5870 **Preventing coal sticking in bunkers.** Shatokha, I.Z. *Koks Khim.;* No. 11, 3-5(Nov 1976).

When the bunker outflow section is formed from a cylinder and a cone, the coal sticks first on the cone shoulders and then spreads to the walls of the cylinder; the resultant narrowing can in certain cases halve bunker capacity. The bunker can be filled to the rim with water, which is allowed to stand and is then discharged. It was found that though the water freed the stuck coal, the moisture content was uneven and there was a tendency for the wet slush to flood the discharge and loading equipment. Live steam at 180°C, 4kg-f/sq.cm at a rate of 40 cu.m in 40 minutes was also allowed to stand. The steam was found to permeate the coal, then condense and thus moisten the coal and break it up. The bunker however still suffered from bridging and corking. A light oil was also tried out and was found greatly to reduce adhesion to the bunker walls. The coals most prone to sticking are fat, coking and high caking types.

5871 **Polyoxyethylene in flotation and filtration of slurries.** Baichenko, A.A. *Koks Khim.;* No. 9, 10-13(Sep 1976).

The accumulation of residual polymeric flocculants in closed water circuits can have a significant effect on the flotation process. It is suggested that anomalous flotation results obtained in some investigations may have been caused by the residual concentrations of polymers. In preparing polyoxyethylene for flocculation, it should be dissolved in high concentration but without the use of vigorous stirring as this tends to destroy the flocculants before it mixes with the slurry undergoing flotation.

5872 **Improvements in fines dewatering technology.** Gizunterman, V.V. *Koks Khim.;* No. 9, 13-15(Sep 1976).

If separate dewatering technology is to be organized for the de-slurried fines and the slurry at the preparation plants, two basic problems have to be solved: firstly to find effective means of classifying the fines at 1 mm level, and secondly to optimize centrifuging conditions. Most Soviet plants are now using cylindro-conical screens giving 95 to 96% efficiency for a loading of 200 t/h, slot width of 1.5—2 mm. Difficulties arise in dewatering de-slurried coal above the 12-1 mm range. The use of a centrifuge with an increased dewatering period and vibro-assisted intermittent cake discharge is suggested. De-slurried coal can be adequately centrifuged down to a moisture of 6-6.5% and therefore needs no further drying. As the coarse slurry is now an independent product, this can be prepared in the normal way even if it has a high ash content, and it need not be directed straight into the washed charge.

5873 **How main process parameters affect centrifugal hydroseparation.** Semenov, I.A. *Koks Khim.;* No. 7, 8-11(Jul 1976).

The efficiency of the hydro-separation centrifuge process increased with increasing ash in the coal slurries. Centrifugal separation of this kind would appear to be promising in view of the deteriorating quality of present day preparation plant feeds. Parameters considered are ash and sulphur in the concentrate, ash and sulphur in the tailings, density, rotor rpm, ash in the original slurry and the depth of the fluid bed in the centrifuge. These are mathematically processed using correlation and regression analysis. The main factors of influence are the quality of the original product, the rpm of the rotor and pulp density which has the greatest influence on any reduction in ash and sulphur.

5874 **Study of the floatability of Karaganda slurries varying in size.** Ol'fert, A.I. *Koks Khim.;* No. 6, 2-6(Jun 1976).

The tests showed a high degree of selectivity but relatively ineffective flotation in the case of a slurry in the 1.0 to 0.5 mm size range, compared with the relatively low selectivity shown when floating a slurry in the minus 0.074 mm range. There is a tendency for ash to increase in both the concentrate and tailings with a

reduction in the particle size. The most effective flotation was obtained in the size ranges 0.25 to 0.074 and 0.5 to 0.25 mm.

5875 How salts affect coal flotation figures. Kovorova, V.V. *Koks Khim.;* No. 6, 6-8(Jun 1976).

Ions accumulating in the recycle water in closed water and slurry systems at preparation plants affect not only the liquid phase flotation pulp but also the solid surface of the slurries. This is an effect which can be observed for various ranks of coal. The concentrations of ions in excess of 100 mg/l reduce the flotation activity of the coal surface and detract from the frothing capacity of the flotation reagents. This shows the need to control the ion composition of the coal pulp if optimum flotation conditions are to be obtained. Industrial trials at one plant confirmed the advantages of this ion control in the liquid phase and showed a considerable increase in concentrate yield and the ash removed with the tailings.

5876 Jigging statistics reveal efficiency. Samylin, N.A. *Koks Khim.;* No. 6, 8-10(Jun 1976).

A formula is proposed for determining the throughput of jigs taking account of the quality of the feed concentrate. This particular relationship characterizes the efficiency of the jig. Analysis has shown that with increasing rate of bed formation, there is an increase in productivity of the jig. The rate at which the bed forms depends on the properties of the coal and a number of other factors, especially the skill of the operators. The bed-forming rate can be found numerically on the basis of industrial trials on a number of jigs to find the actual throughput of a jig and the total misplaced material in the jig product.

COMBUSTION

REFER ALSO TO CITATION(S) 5770, 5820, 5821, 5857, 6526, 6533, 6534, 6535, 6541, 6557, 7465

5877 (ERDA—77-64) **Effects of trace contaminants from coal combustion. Proceedings of a workshop, Knoxville, Tennessee, August 2—6, 1976.** Van Hook, R.I.; Shults, W.D. (eds.). (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Biomedical and Environmental Research). Jun 1977. 83p. Dep. NTIS, PC A05/MF A01.

Four panel reports were presented as follows: Characterization and analysis; Environmental transport; Ecological effects; and Health effects. These reports were abstracted and indexed separately.

5878 (FE—1536-30(Vol.1)) **Energy conversion from coal utilizing CPU-400 technology. Final report. Volume I.** Phillips, K.E. (Combustion Power Co., Inc., Menlo Park, Calif. (USA)). Mar 1977. Contract EX-76-C-01-1536. 155p. Dep. NTIS, PC A08/MF A01.

The CPU-400 Process Development Unit was used to demonstrate the viability of the direct-coal-fired gas turbine using high-sulfur coal. Over 3000 hr of coal-combustion testing were carried out in a 2.2-sq ft atmospheric combustor and the 4-atmosphere PDU, almost all of it with Illinois No. 6 coal containing about 4 percent sulfur. In almost 600 hr of coal combustion in the PDU, the computerized process-control system demonstrated a capability for accurate automatic control. Combustion efficiency exceeded 99 percent, with minimal afterburning in the combustor freeboard. In steady-state operation with 300 percent excess air, the stack emissions of NO/sub x/ remained consistently below EPA limits. Tests in the atmospheric unit demonstrated over 90 percent sulfur suppression when a cyclone separator returned unspent dolomite fines to the fluid bed. In the PDU, without fines return, acceptable sulfur suppression was approached using an aged dolomite bed, at a Ca/S mole ratio of 1.75. Reverse-flow inertial separator tubes proved ineffective for hot-gas cleanup because of the stickiness of the ash, which resulted in plugging of the tubes. Temperature, in terms of both level and constancy, is shown to be the single most important factor in determining whether or not sulfidation will occur in a coal-burning system. At 1600°F, with or without additives, no evidence of sulfidation was found in turbine-blade materials; even brief excursions above 1740°F, however, produced easily detectable sulfidation in the more susceptible alloys. The turbine alloys most resistant to oxidation attack in the coal-combustion atmosphere at 1600°F are those containing high aluminum concentrations, such as IN 713 and IN 738; the most resistant non-turbine materials are those high in chromium.

5879 (FE—1536-30(Vol.2)) **Energy conversion from coal utilizing CPU-400 technology. Final report, Volume II.** Phillips, K.E. (Combustion Power Co., Inc., Menlo Park, Calif. (USA)). Mar 1977. Contract EX-76-C-01-1536. 236p. Dep. NTIS, PC A11/MF A01.

This program was performed to assist in analysis of the gaseous, vapor phase, and particulate environment from their limestone fluidized bed combustor operating on Illinois No. 6 coal and to predict the effect of the environment on a power extraction gas turbine. The particulate material is primarily anhydrite ($CaSO_4$) with hematite (Fe_2O_3), and quartz (SiO_2). An Arrhenius corrosion rate plot of the ash on a typical base superalloy, MAR-M421, is shown in FA-1. An ash containing 80 ppM of alkali chloride was only mildly corrosive at a typical turbine operating condition, 816°C (penetration was only 77μm [0.003 inch]/10,000 hr). Erosion/fouling thresholds were determined for the two system ashes and a synthetic ash (contained major constituents in the ash only and was low in alkali). The magnitude of the fouling problem is illustrated in FA-3 at various fly ash concentrations under conditions in the Solar atmospheric high velocity erosion rig. The results show that, at the lowest particle concentration objective set to date for dust separation systems (70 mg/m³), a buildup of a deposit 2500μm will occur in 200 hr. Considering the difference in mass flow between the rig and a low compression ratio gas turbine (6:1), the noted buildup could occur in 1/6th the time.

5880 (FE—2222-7) **Full-sclae utility boiler test with solvent refined coal (SRC). Technical progress report, June 1977.** McRanie, R.D. (Southern Co. Services, Inc., Birmingham, Ala. (USA)). 31 Aug 1977. Contract EX-76-C-01-2222. 10p. Dep. NTIS, PC A02/MF A01.

Phase II testing, including tests across the Unit 1 secondary precipitator, was completed in early June. Due to the Southern Company system load demand during the summer months, a meeting was held with production personnel to discuss the Phase III outage schedule. To minimize the Phase III outage, the use of Babcock and Wilcox (B and W) construction crews for two 10-hour shifts per day was authorized. The startup period using solvent refined coal (SRC) was June 10 to 12, formal Phase III testing began on June 13, and the available SRC supply was exhausted on June 28. Unit 1 was then returned to an interim condition such that coal could be burned. Further modifications of Unit 1 will be planned and performed later this year after the summer peak load season.

5881 (FE/1536—1) **Energy conversion from coal utilizing CPU-400 technology. Volume I. Final report.** (Combustion Power Co., Inc., Menlo Park, Calif. (USA)). Mar 1977. Contract EX-76-C-0-1536. 154p. Dep. NTIS, PC A08/MF A01.

The CPU-400 Process Development Unit was used to demonstrate the viability of the direct-coal-fired gas turbine using high-S coal. Objectives of the test program included demonstration and evaluation of total system and subsystem performance, process controllability, and system effectiveness in suppression of noxious stack-gas emissions, as well as identification and solution of process and hardware problems and an assessment of hot corrosion (sulfidation) and means for its prevention. In almost 600 hours of coal combustion in the PDU, the computerized process-control system demonstrated a capability for accurate automatic control of the process during startup and normal operating modes as well as transient conditions. Combustion efficiency exceeded 99 percent, with minimal afterburning in the combustor freeboard. In steady-state operation with 300 percent excess air, stack emissions of NO/sub x/ remained consistently below EPA limits. Reverse-flow inertial separator tubes proved ineffective for hot-gas cleanup because of the stickiness of the ash, which resulted in plugging of the tubes. Cyclone separators alone did not provide removal of fine particulate adequate either to meet environmental standards or to assure continuous long-term operation of the turbine. A moving-bed granular filter, designed to remove fine particulate not captured by cyclones, showed operational capability, but structural inadequacy of filter-panel supports prevented a full evaluation of the device.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 6954

5882 (EPRI-EA—496(Vol.2)) **Economic analysis of coal supply: an assessment of existing studies. Volume 2.** Gordon, R.L. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Economics). Jul 1977. 182p. Dep. NTIS, PC A09/MF A01.

Reviews and critiques of recent studies pertaining to coal supply economics are presented. Two earlier sets of reviews of coal-supply studies by Gordon have been published by EPRI. The reviewed studies range from comprehensive treatments of coal economics to brief papers dealing with narrow issues. The largest-scale efforts reviewed are those of ICF, Incorporated, including the "National Coal Model" developed for FEA, and a model developed by the Research Program on Science and Technology of the Thayer School of Engineering of Dartmouth College. A coal model developed for the Potomac Electric Company by Charles River Associates is also reviewed.

5883 Industrial market for coke oven gas. Jones, D.R.; Smith, S.F. *Gas World;* **182**: No. 4700, 234-239(Apr 1977).

The work of National Smokeless Fuels Ltd.'s Engineering Department in connection with sales of coke oven gas and provision of coke oven gas distribution pipelines is described.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 5843, 5860, 5865, 7513

5884 (ARP—47) **Estimation of the tangible costs of black lung disease related disability to the bituminous coal mine operators of Appalachia.** Cameron, R.B. (Tennessee Univ., Knoxville (USA). Appalachian Resources Project). 15 Jun 1976. 133p. of Tennessee, Appalachian Resources Project, Knoxville.

The early work on estimating the contribution of black lung disability to the costs of coal production consisted of an extensive survey of the medical literature: To determine what black lung disease is and how it may be related to the process of mining coal; and to determine the nature of any disability which may result. The disease itself is not well defined, there being a multiplicity of disorders associated with what is loosely called black lung disease. It was evident, however, that there is excessive lung-disease-related disability among underground bituminous coal miners. The data tape of the Appalachian Laboratory for Occupational Respiratory Disease (ALFORD) 1969 to 1971 coal workers' pneumoconiosis prevalence study includes substantial medical information on some 10,000 miners and served as the sample for the disability cost estimates. Because of incompleteness of data clinical criteria could not be used to determine the presence of disability. The ALFORD tape, however, includes information by which miners could be categorized subjectively according to complaints of shortness of breath, dyspnea, which was chosen as the indicator of disability. The decision to use dyspnea as a criterion for disability is supported by: First, shortness of breath, to a large extent, is responsible for the inability of diseased miners to work at the rate of their healthy peers; and, secondly, the ALFORD dyspnea data are consistent with the Public Health Service 1963 study. The cost estimates include: (1) Estimate of the increase in output which might be expected to occur with the elimination of black lung disability; or (2) estimate of a discounted income stream lost because of the disability. Each of these estimates yield a range of costs from one to five percent of the annual total product revenue of the bituminous coal industry.

5885 (ERDA—77-64, pp 59-76) **Health effects.** Morrow, P.E.; Bingham, E.; Borg, D.C. Jun 1977.

In Effects of trace contaminants from coal combustion.

The objectives of the workshop from the perspective of the Health Effects Panel were to determine which if any of the trace inorganic and organic contaminants from coal combustion are likely to produce adverse effects on health or modify our general toxicologic appraisal of the major effluents of coal combustion (i.e., NO/sub x/, SO/sub x/, and particulate matter) and to decide what additional research is needed with priorities assigned. Any assessment of possible health effects from coal combustion contaminants requires, inter alia, definition and quantitation of source and transport terms. Given information on "what" and "how much" can be breathed and ingested, an evaluation of the human exposure and intake estimations can proceed utilizing background, dietary, occupational, experimental, and environmental information, provided these data exist. Using compositional data for coal and fly ash, the Health Effects Panel developed a provisional list of trace organic and inorganic contaminants on the basis of their toxic potential and relative abundance. These were as follows: Trace organics, alkyl and polyaromatic hydrocarbons (PAH) and their oxidation products, simple aromatics, particle-associated organic materials (PPOM), and trace inorganics, Pb, Cd, Hg, V, As, Ni, F, Cr, Be, U, Se, Mo, Sb, Th, Tl, and Rn. The elements U, Th, and Rn were reviewed in terms of the potential population dose commitment from radiation, assuming secular equilibrium existed between these radionuclides and their progeny. Uranium was also assessed from the viewpoint of its chemical toxicity. This provisional list includes most of the known trace organic constituents of coal combustion and approximately one-half of the trace inorganics which have been identified as potentially important.

5886 **SA ice-jacket unsatisfactory.** *Coal, Gold Base Miner. South. Afr.;* **24**: No. 11, 69-73(Nov 1976).

The U.S. Bureau of Mines has developed a lightweight, nonbulky ice cooling garment for mine rescue purposes. The South African ice jacket, a garment which uses dry ice inserted into pockets, and a garment which uses cold water pumped through tubes were found unsuitable. The new garment is open at the sides, and is cooled by pockets of ice attached to it by Velcro strips. Results of tests in which the new jacket was worn are reported.

REGULATIONS

REFER ALSO TO CITATION(S) 5827, 6954, 6955

PETROLEUM

REFER ALSO TO CITATION(S) 6957

5887 (CONF-7604127—P1) **California oil and gas facts. Part I.** (California Div. of Oil and Gas, Sacramento (USA)). 1976. 79p. Div. of Oil and Gas, Sacramento.

From Workshop on urban oil and gas development; Sacramento, California, United States of America (USA) (6 Apr 1976).

The California Division of Oil and Gas was awarded a grant by the Federal Energy Administration to conduct a study of problems involved with the recovery of oil and gas resources in urban areas of California. The purpose of the study was to investigate the impact of increasing urbanization and intensive land use on oil and gas operations in these areas. The objective of the study is to reconcile the programs and goals of the urban community with those of the industry that provides them with the energy necessary for their existence. The study includes an inventory of the energy resources of the region; current status of development; examination of taxation, regulation and zoning ordinances; and a discussion of environmental, political, and social pressures. A conference or workshop was held with industry, government, environmental, and business representatives to objectively delineate the problems and to determine possible solutions. The proceedings of that conference are published as Part II of this booklet. The intent in publishing Part I "California Oil and Gas Facts" is to provide insight into the oil and gas industry and its relevance to all levels of government and human well-being. The statistics published in this edition are from the most recent data available from the various sources at the time of publication.

5888 (CONF-7604127—P2) **Workshop on urban oil and gas development. Part II.** (California Div. of Oil and Gas, Sacramento (USA)). 1976. 32p. Div. of Oil and Gas, Sacramento.

From Workshop on urban oil and gas development; Sacramento, California, United States of America (USA) (6 Apr 1976).

Workshop recommendations are made that may resolve or at least lessen significantly the problems and conflicts presently associated with urban oil and gas field development in California. Many constructive ideas and thoughts were expressed during the two-day Urban Oil and Gas Development Workshop. Concepts that represented group consensus are summarized. The workshop consensus is that more communication is necessary between the oil industry and local and state governmental agencies; most environmental and regulatory problems concern older oil field operations where urban growth is occurring and compulsory unitization may provide solutions to many of these problems; the Division of Oil and Gas should clarify Division 3 of the State Oil and Gas Code in regards to preventing damage to life, health, property, and natural resources; regulations are needed for oil field pipeline abandonment and removal; a bond should be of an adequate amount to ensure proper abandonment, and the bond should last for the life of the well—a periodic renewal system might be incorporated into the present bonding procedure to see that they remain adequate; and safety regulations concerning anchoring of derricks should be established. (JRD)

5889 **Geology and energy resources of the Powder River.** Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976). 328p. (CONF-7609159—).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

Papers are included on stratigraphy structural geology, petroleum, coal, uranium, bentonite, water resources, geochemistry and road logs. Twenty-nine of the papers were processed individually. (JRD)

RESERVES

REFER ALSO TO CITATION(S) 6886

5890 (NP—22424) **Reserves: a better understanding.** Keplinger, H.F. (Keplinger and Associates, Inc., Tulsa, Okla. (USA)). 1976. 23p. and Associates, Inc., Houston, TX.

Oil and gas reserves, and methods for estimating them, are discussed. Reasons for differing estimates are discussed. These estimates include initial volumetric, mid-life volumetric, and decline

estimates. A typical cash flow projection is given for a producing well. In most cases, reliable reserve calculations can be made through proper engineering and geological assumptions, adequate data, and familiarization with the geological and reservoir characteristics of the area. (11 figs and tables) (DLC)

GEOLOGY AND EXPLORATION

REFER ALSO TO CITATION(S) 5939, 7323, 7614

5891 Depositional environment of the oligocene rupel clay in well Grashoek-1, Peel region, the Netherlands. Brouwer, J. (Shell Int Pet Maatsch, The Hague, Neth). *Geol. Mijnbouw;* **56**: No. 1, 25-30(Mar 1977).

A continuously cored marine Oligocene Rupel Clay of the N.A.M. well Grashoek-1 (Peel region, the Netherlands) yielded a benthonic foraminiferal fauna indicative of a bathyal environment with a seadepth below 300-500 m. For the purpose of determining the environment of deposition of this Rupel Clay a closely sampled series of core material is studied quantitatively and qualitatively on the presence of foraminifera and other microfossil remains. The method of investigation applied, the interpretation of the environment of deposition, conclusions, a bibliography and check list of foraminiferal species are also given. 29 refs.

5892 Biostratigraphy of cretaceous calcareous nannoplankton. Sissingh, W.; Prins, B. (Shell Int Pet Maatsch, The Hague). *Geol. Mijnbouw;* **56**: No. 1, 37-65(Mar 1977).

The stratigraphical distribution of selected species of calcareous nannoplankton from sections of Cretaceous deposits in Tunisia, France, The Netherlands, West Germany, Great Britain, Denmark, Turkey, Oman and New Jersey is studied. A number of Late Cretaceous lineages is recognized, on which a proposal for a revised zonation is based. Twenty-six zones are distinguished for the Cretaceous interval. First-order correlations between zones and Cretaceous stage-stratotypes are discussed briefly. The Upper Cretaceous part of the proposed zonation is correlated with planktonic foraminiferal zones. One new genus and two new species are described. 74 refs.

5893 Mesozoic and early Cenozoic geology of offshore Nova Scotia. Given, M.M. (Shell Can Ltd, Calgary, Alberta). *Bull. Can. Pet. Geol.;* **25**: No. 1, 63-91(Mar 1977).

Sedimentation on the Nova Scotia Shelf from Late Triassic - Early Jurassic to the end of Neocomian time was strongly influenced by the configuration of the Paleozoic basement. Initial deposition consisted of red beds, dolomite and halite in rift valleys which formed before breakup of the continental mass. The first major marine transgression occurred in Middle Jurassic time and is indicated by marine sands, limestone and shale. The Turonian - Early Maestrichtian world-wide transgression is evidenced by the occurrence of deep-water shales, pelagic chalk deposits and minor sands. Prograding shale wedges filled this basin in Late Maestrichtian - Paleocene time. These generally deep-water environments prevailed until Early Oligocene time, when the configuration of the shelf and the depositional environments began to approach those of the present day. 14 refs.

5894 Novye napravleniya poiska mestorozhdenii nefti i gaza. (New trends in the search for petroleum and gas deposits). Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). 127p.

Separate abstracts were prepared for the 20 papers. (DLC)

5895 Ways of increasing the efficiency of industrial-scale surveying for oil deposits in Central Priob. Aleksin, A.G.; Derevyagin, A.A.; Ishaev, V.G.; Sadykova, R.F.; Torshilova, T.E. pp 3-7 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

An analysis is made of the commercial surveying of a number of large oil deposits of Central Priob' in Western Siberia, by means of which it was possible to recommend an improved technique of developing new oil fields. A detailed seismosurvey should be conducted with profiles placed at a distance of 1 to 1.5 km. Surveying of new fields should be carried out in two stages. The first stage determines the field size, basic strata and main structural features, and oil reserves. The second stage is developmental, and it absorbs most of the expenditures. Well placement and distance between wells depends on the absolute size of the structure, morphological features, etc. (SJR)

5896 Methodical scheme of the sequence of developing geological—geophysical data in the search of lithological and stratigraphical deposits of oil and gas. Kozhevnikov, I.I.; Kuznetsov, S.V.; Yudin, G.T. pp 7-13 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

A look is taken at the role of various geological factors in forming nonstructural traps and determining the prospects of finding oil. A methodical scheme is proposed for the sequence in carrying out an analysis of the geological-geophysical data in the search for lithological and stratigraphic deposits of oil and gas in terrigenic strata. The significance of this technique is shown in finding regional zones of lithological tapering and of stratigraphic variance, isolating traps in these zones, estimating the productivity of the zones, and in carrying out the survey studies efficiently.

5897 Technique of preliminary estimating the oil—gas content of structural zones and local uplifts with south Mangyshlak as an example. Aleksin, A.G.; Shardanov, A.N.; Chechetkin, S.I. pp 13-17 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

A look is taken at a number of theoretical questions of a rational technique of deep drilling for gas and oil with the use of South Mangyshlak as an example (system of spacing and succession of well drilling with features of the geological structure and oil-bearing content of structural zones and local uplifts being taken into account). (SJR)

5898 Technique of a combined study of the Precaspian depression by reference polygons and search bands. Dolitskaya, T.V.; Khromov, V.T. pp 17-22 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

Justification is given for theoretically new methodical methods of carrying out regional and detailed search studies in the Precaspian depression. Starting from developed features of the geological structure of the region it is recommended that the studies be concentrated along bands of definite width, which radially dissect the depression, with the purpose of obtaining a definite volumetric conception about regional zones of oil-gas accumulation and types of search sites in the zones. The use of the proposed technique is demonstrated in concrete fashion with the western part of the Precaspian depression as an example. (SJR)

5899 Comparative analysis of the technique of regional geological—geophysical studies in north, south, and central Ustyurt. Astaf'eva, L.F. pp 22-25 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

A characterization is made of the state of regional geological-geophysical studies, and of the problems at a given stage of study, which assures the isolation of the most prospective zones of oil-gas accumulation. A look is taken at the types and resolving ability of methods in various sections of the region applicable to the actual geological conditions of Ustyurt. (SJR)

5900 Technique of searching and surveying for screened oil deposits in the Bukharo-Khivinskii region. Zor'kin, Ya.M. pp 46-52 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

The degree of study of the Bukharo-Khivinskii, oil-bearing region by drilling and geophysical methods shows that at present the search and survey of the screened type of oil and gas deposits is economically suitable on territory of the Bukharskii ladder. A total of 15 prospective zones were established. A search and survey technique is outlined, and the first oil sites were isolated. 1 fig., 11 refs. (SJR)

5901 Unified nomenclature for a system of productive strata in Mangyshlak and Ustyurt. Korchin, O.P. pp 52-55 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

As a result of studying the data from deep wells in the jurassic stratum of Mangyshlak and Ustyurt, a total of 20 lithological blocks were isolated, which are productive strata, and also their analogues which were first united into a single, scientifically-justified, nomenclature system. 3 tables, 2 refs. (SJR)

5902 Stratigraphic boundary of the Jurassic and Cretaceous of the Mangyshlak region in connection with searching for traps of the lithological type. Korchin, O.P. pp 55-59 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

Justification is given for the presence of deposits of the Tithonian era within the boundaries of South Mangyshlak, and their prospects for finding oil. 1 fig., 8 refs. (SJR)

5903 Estimating techniques of isolating regional structures in the salted-over complex of the Precaspian depression. Dolitskaya, T.V.; Khromov, V.T. pp 59-65 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

A look is taken at methods of separating out the regional structure of the salted-over complex of the Precaspian depression under conditions of the appearance of a massive salt diapirism, and

an estimate is made of the synthesis of structural and paleostructural maps of various investigators. A substantial difference is noted in their conceptions about the regional structure of salted-over deposits of the Precaspian depression and its role for gas and oil accumulation. It is recommended that effective suppression of local salt tectonics be carried out according to a specially developed technique, by means of which it is possible to separate out in a reliable fashion regional zone overlain with thick salt deposits. The practical significance of the zones is confirmed by opening up within their boundaries a series of oil and gas deposits in the western part of the Precaspian depression. 24 refs. (SJR)

5904 Theoretical problems in techniques of regional geological—geophysical studies (the Lower Povolzh as an example). Aksenov, A.A.; Kozhevnikov, I.I.; L'vovskii, Yu.M. pp 65-70 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

It is shown that it is necessary to subdivide stages of regional studies into three cycles, which substantiate a quantitative estimate of three subgroups of oil reserves (D_1, D_2 and D_3). Features are presented for a combined technique of seismo-surveying and parametric drilling in regional studies. Calculations are presented for rational amounts of parametric drilling in planning regional, geological-geophysical studies of various cycles. 11 refs. (SJR)

5905 Features of searching for oil and gas deposits in mesozoic sediments of the leading ridges in territory of the Checheno-Ingushskii ASSR. Bairak, I.K.; Tomkina, A.V. pp 70-75 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

In connection with finishing up in the near future the survey of upper cretaceous deposits on leading ridges the problem of searching for hydrocarbon accumulation in the most submerged part of the mesozoic deposits has acquired particular importance. From an analysis of seismic and drilling data it was possible to conclude that the first deep exploratory wells for underthrust, jurassic salt deposits should lie in the southern, near-the-dome, sections of the anticlinal uplifts of the Sunzhenskii ridge, and in confirming the regional character of the southern suboverthrust—to the north from domes of overthrust salt structures of the Terskii ridge. 3 figs., 2 refs. (SJR)

5906 Technique of searching for oil deposits in salted, jurassic sediments of the Vostochno-Kubanskii depression (with the Labinskii area as an example). Melik-Pashaeva, N.V.; Tomkina, A.V. pp 75-82 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

Data are presented on the results of drilling and testing along the Labinskii area. In order to obtain more information on the structure of underthrust salt deposits it is proposed that wells be placed in a direction west from the productive wells. 2 figs., 2 refs. (SJR)

5907 Role of paleotectonic analysis in the search of lithological and stratigraphical deposits of oil and gas (with the lower cretaceous deposits of the Precaucasus as an example). Kuznetsov, S.V. pp 82-91 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

The formation of traps of a nonstructural type is directly related to the history of tectonic development. Therefore from a paleotectonic analysis it is possible not only to distinguish traps of a nonstructural type, but also to estimate the possibility of finding gas or oil. In the lower cretaceous deposits of the Precaucausus a total of 40 traps were distinguished, out of which nine traps can be considered as prime targets for search-survey studies. 4 figs., 6 refs. (SJR)

5908 Classification of hydrocarbon traps associated with ancient shore lines and accumulative forms of relief of paleobasins. Kovalenko, E.G. pp 91-98 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

On the basis of evolutionary-genetic and era-historical principles a logical scheme (a periodic table) of seashores is composed with quantitative mutual relationships being taken into account. This scheme is tied in with a system of hydrocarbon traps associated with ancient shorelines and accumulative forms of relief of paleobasins. 2 tables, 2 refs. (SJR)

5909 Features of studying prospective prejurassic deposits of Ustyurt. Zhuravleva, P.I.; Astaf'eva, L.F. pp 98-101 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From seismosurvey and drilling studies of recent years, new data are presented on the geological conditions for the deposition of prejurassic complexes. A number of recommendations are given in searching for oil and gas deposits at great depths of Ustyurt. 5 refs. (SJR)

5910 Geological effectiveness of seismosurveying in the southeast part of the Precaspian depression. Brenner, V.M. pp 102-104 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

A look is taken at the results of studying the structure of overthrust salt deposits by seismic methods. The accuracy of the studies is estimated in correspondence with the seismogeological conditions. Recommendations are given on carrying out seismosurvey studies and on increasing the reliability of the studies. 2 refs. (SJR)

5911 Features of the geological structure of the Jurassic, Terrigenic strata of the platform section of the eastern Precaucasus, and conditions for the formation of oil deposits. Principles for developing a rational search technique. Aleksin, A.G.; Plotnikov, M.S.; Miroshnikov, M.S.; Yudin, G.T. pp 104-110 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

On the basis of studying the conditions of sediment accumulation, the hydrogeological situation, collector properties and commercial oil-gas content, an attempt is made to estimate the time of forming hydrocarbon deposits, and a prognosis is made for finding gas and oil in basic, sand-siltstone pockets of the jurassic stratum in the Eastern Precaucausus. (SJR)

5912 Upper Cretaceous Gammon, Shannon, and Sussex sandstones, central Powder River Basin, Wyoming. Crews, G.C. (Barlow and Haun, Inc., Casper, WY); Barlow, J.A. Jr.; Haun, J.D. pp 9-20 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

A brief over-view is given of the stratigraphy of Upper Cretaceous rocks in the Powder River basin, and the stratigraphy and petroleum geology of the Gammon, Shannon, and Sussex sandstones in a 63-township area in the central part of the Powder River basin (Ts. 44-50N., Rs. 73-81W.) are discussed. The Gammon, Shannon, and Sussex sandstones are offshore marine sandstones up to 30 feet thick encased in a marine shale sequence several hundred feet thick. Approximately 280 wells in the 63-township area have penetrated this sandstone and shale sequence (commonly called the "upper Cody") and practically all of the drilling has been done in the last five years. At the end of 1970 there were only 19 wildcat wells that had penetrated the Shannon sandstone in the part of the 63-township and downdip from Kitty field. As of March 1, 1976, there are 200 producing wells in nine fields with primary reserves of about 25 million barrels of oil. (JRD)

5913 Late Cretaceous Teapot delta of Southern Powder River Basin, Wyoming. Curry, W.H. III. pp 21-28 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Kerogen contained in dark marine shales above and below the Teapot sandstone has apparently reached temperatures in the deeper part of the Powder River Basin sufficient to retort the kerogen naturally to oil and gas. After migration vertically up and down along fractures, some of the hydrocarbons apparently entered the Teapot sandstone reservoir in the hot basin deep and then migrated updip into the stratigraphic traps that are currently being developed, as at Well Draw Field. It is postulated that this general source of hydrocarbons has supplied oil and gas to the Teapot reservoirs at Flat Top, Well Draw, Kaye, and possibly other similar undiscovered slope sandstone traps on the east flank of the basin. It is clear that significant volumes of oil and gas have migrated from the basin deep up the east flank of the Powder River Basin, similar volumes of hydrocarbons have not yet been found on the west flank of the basin. For example, closed anticlinal structures with thick buried Teapot sandstone reservoirs at Cole Creek and South Cole Creek are barren of Teapot hydrocarbons. It is possible that no Teapot oil and gas migrated westward out of the basin to fill these structural closures but more likely that hydrocarbons have simply been trapped downdip from the anticlines barren of Teapot oil. If oil and gas were trapped stratigraphically downdip in bar sandstone bodies similar to those illustrated at Big Muddy-South Glenrock, an exceptional group of Teapot stratigraphic oil accumulations await discovery. Drilling is so sparse on the west flank of the basin that it is impossible at this time to evaluate this exploration possibility further.

5914 Upper Cretaceous Shannon Sandstone: an offshore, shallow-marine sand body. Spearing, D.R. (Marathon Oil Co., Littleton, CO). pp 65-72 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).
See CONF-7609159—.

The stratigraphic sequence, internal structures, transport directions, and sand body geometry of the Shannon Sandstone are discussed. The Shannon is interpreted as an offshore shallow-marine sand that was transported consistently, but intermittently, in a longshore direction by a combination of tidal or oceanic currents and storm waves. The shelf character of the Shannon was first suggested by Parker (1958) in the 13th Wyoming Geological Association Guidebook. Paleontological evidence led Gill and Cobban (1966) to a similar conclusion. Study of the stratification and sand body geometry of the Shannon confirmed these prior conclusions. In the southwest corner of the Powder River Basin, the Upper Cretaceous, Lower Campanian Shannon Sandstone Member of the Cody Shale is well exposed on the Salt Creek anticline, and on a 50-km long hogback ridge west of the anticline. A large number of oil wells around the Salt Creek Structure create the opportunity to compare outcrop and subsurface information over short distances, and to thereby work out sand body shape and distribution. Results of such a study of the Salt Creek outcrops, coupled with nearby subsurface correlation are summarized. (JRD)

5915 Regional distribution of environments of the Muddy Sandstone, southeastern Montana. Waring, J. (Geological Survey, Casper, WY). pp 83-96 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).
From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).
See CONF-7609159—.

Localized depositional environments of the Muddy have been established by interpretation of sedimentary structures, petrography, and paleogeography. These interpretations were then integrated into an overall depositional history of the area. During Lower Cretaceous time, the Powder River Basin developed a westward tilt that caused a regression of the Skull Creek Sea, and a new shoreline developed in eastern and southeastern Montana. Due to a low influx of sediments, large areas of the Skull Creek were exposed to erosion, and a dendritic system developed over much of the area. The lack of sediment supply, coupled with a gradual subsidence, allowed the Lower Muddy Sea to transgress the channeled surface of the Skull Creek. Deltas developed in the central and northern part of eastern Montana and supplied sediments southward by means of longshore currents. The shoreline became dominated by longshore currents and the Skull Creek valleys began to be filled by fluvial deposits. The sea was slowly encroaching on these valleys, with the probable development of some drowned valleys, best illustrated by the bays in the 3rd and 4th zones. By the deposition of the Middle Muddy, all of the channels had been filled. While southeastern Montana and Wyoming were undergoing a marine transgression, deposition in central and northern Montana continued to be dominated by progradation of deltas. Sediments in the south were reworked to some extent during the Upper Muddy and spread into more sheet-like deposits, although still marginal marine.

5916 Geologic map of Paleozoic and mesozoic rocks, east flank of the Bighorn Mountains from lat. 44° 37′ 30″ N. to lat. 44° 52′ 30″ N., Sheridan County, Wyoming. Langenheim, R.L. Jr.; Reinbold, M.L.; Tissue, J.S. (Univ. of Illinois, Urbana). pp 97-105 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).
From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).
See CONF-7609159—.

Preliminary geologic maps of the area are presented for development of information on mineral fuel deposits. Mapping was done in the field on mylar overlays laid on aerial photographs flown in 1954 for the U.S. Department of Agriculture. This geologic mapping was transferred by inspection to black-line copies of U.S. Geological Survey 7½′ Series Quadrangle Maps as indicated. Maps for publication then were traced from the quadrangle maps with omission of the light-line contours, much of the drainage and most of the cultural features shown on the originals. These tracings then were reduced photographically to publication scale. The map area includes parts of Skull Ridge, Dayton South, Wolf, Walker Mountain, Beckton and Beaver Creek Hills Quadrangles. In addition, nine cross sections have been prepared. Mapping is confined to the sequence between the base of the Cambrian Flathead Sandstone and the base of the Cretaceous Lance Formation and, between these limits, is essentially complete for all quadrangles with the exception of Skull Ridge. (JRD)

5917 Sussex Sandstone production, Triangle U field, Campbell County, Wyoming. Anderman, G.G. pp 107-113 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).
From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).
See CONF-7609159—.

The Sussex Sandstone, a member of the Cody Shale, produces at the Sussex and Meadow Creek fields in the southwestern Powder River Basin, and from the House Creek, Payne, and Triangle U fields of the central Powder River Basin. The Sussex and Meadow Creek fields were discovered in 1947 as a result of drilling seismic anomalies. The House Creek and Payne fields were discovered in 1968 and 1969 as a result of exploration for production from the Lower Cretaceous Muddy and Dakota Sandstone after the discovery of Bell Creek. The Triangle U field was discovered in October, 1974, and was drilled as a Sussex Sandstone stratigraphic prospect. Following discovery, development was rapid, and by April 15, 1976, 25 producing wells and four dry holes had been drilled. The Triangle U field is located approximately 3½ miles west of the north end of the House Creek field. The main productive sandstone at Triangle U occurs higher stratigraphically than the main productive sandstone at House Creek. The Sussex Sandstone reservoir is remarkably narrow compared with its length. To date, the proven Sussex reservoir at Triangle U is approximately 7½ miles long and averages slightly in excess of ½ mile in width. Structure in the Triangle U area exhibits regional southwest, monoclinal dip at a rate of approximately 125 feet/mile, and stratigraphic strike is nearly parallel with structural strike. Through February, 1976, the field produced 341,845 barrels of oil. However, it should be realized that for many of the wells of the field, this represents very few months of productive history.

5918 Deadman Creek field. Arro, E. (Burlington Northern, Inc., Billings, MT). pp 115-120 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).
From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).
See CONF-7609159—.

Deadman Creek field is located 20 miles north of Moorcroft in Crook County, Wyoming on the east flank of the Powder River Basin. The field covers portions of sections 18 and 19, T. 53 N., R. 67 W., and sections 13 and 24, T. 53 N., R. 68 W. The Deadman Creek field is producing from the Minnelusa lower "B" sand. Production has been fully defined with 5 producing wells and 11 dry holes. Fluid expansion accounts for production. The field has been unitized and is awaiting state approval for the initiation of a secondary recovery program using either a water flood or chemical polymer techniques. (JRD)

5919 Environmental interpretation of the Upper Cretaceous Shannon Sandstone, Heldt Draw Field, Wyoming. Davis, M.J.T. pp 125-138 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).
From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).
See CONF-7609159—.

The stratigraphic relations and deposition of the Shannon sands are considered. The Shannon sandstone of the Heldt Draw area was deposited in an outer shelf position 150 miles or more offshore. Reservoirs are not "sand buildups per se," but were developed within a zone of mixed silt and fine sand, by higher velocity tidal or oceanic currents, agitated by intermittent storm cycles or shoaling. Winnowing of the sandy material in the higher flow regimes cleaned and sorted the sands, resulting in average porosities up to 12%. Early generation and migration of hydrocarbons into the porous lenses of sand, created a series of stratigraphic accumulations in the area. The type of deposition and trapping mechanism in the Shannon is very similar to the Sussex sands described by Berg at House Creek Field (Berg, 1975). The Heldt Draw-Indian Creek Shannon trend is open-ended both to the north and south. New fields similar to Heldt Draw should be discovered through the "fairway" across the Johnson and Sheridan Counties, Wyoming and on into southeast Montana. It is hoped that political and economic factors will allow exploration programs to continue the search for more Shannon reserves.

5920 Powell-Ross field Converse County, Wyoming. Hando, R.E. (Woods Petroleum Corp., Denver). pp 139-145 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).
From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).
See CONF-7609159—.

Powell-Ross field is located in the southwestern part of the Powder River basin, Wyoming. Powell field was discovered February 7, 1975, by Woods Petroleum Corporation when its Powell II Unit No. 1 well (located in the C SE/4 Section 25, T40N, R74W) penetrated seven feet of the first Frontier sandstone and a substantial "gas kick" was recorded. The mud weight was raised to 14 pounds

per gallon before drilling operations were continued. The Powell-Ross field area presently has six wells capable of production, two wells are testing, and production casing was recently run on the Powell II Unit No. 4 (C SE/4 Section 36, T40N, R74W). One well produces from the Dakota Formation and five produce from the first Frontier sandstone. The field is presently being developed on 640-acre spacing and active development is taking place at the present time. A subsurface interpretation of the Powell-Ross field is presented using electrical log surveys and sandstone geometry only, inasmuch as none of the wells within the field area have been cored.

5921 Fall River ("Dakota") oil entrapment, Powder River Basin. Harris, S.A. (Skelly Oil Co., Denver). pp 147-164 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

The location of additional entrapments of hydrocarbons in the Fall River (Dakota) sands in southeast Montana is discussed by comparison with established production trends in northeast Wyoming. In the study area, the Fall River varies from completely marine through littoral to partly continental from west to east. A basal Fall River marine shale tongue transgresses the Lakota disconformity, a basal Lower Cretaceous fluvial unit, eastward from the Fall River-Skull Creek seaway to a position near the Wyoming-South Dakota line. The following Fall River regression brought marine sand deposition far to the west. East of the basal marine shale transgression, Fall River sands may lie directly on Lakota sands, and in this direction the Fall River is only partly marine, with numerous fluvial channels. On the southeast side of the Black Hills, Waage (1958) recognized a continental unit within the normal littoral and marine type Fall River units. In the subsurface, a separation of the Fall River and Lakota becomes very difficult where the basal Fall River shale is absent. In this area, it is preferable to group the Lakota and Fall River as the Inyan Kara Group. (JRD)

5922 Petroleum geology of the Well Draw Field, Converse County, Wyoming. Isbell, E.B. (Diamond Shamrock Corp., Denver); Spencer, C.W.; Seitz, T. pp 165-174 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

The Teapot Sandstone Member of the Mesaverde Formation was deposited in a strand plain-high destructive delta complex during an eastward progradation of the shoreline in Late Cretaceous time. The seaward pinchout of this sandstone forms a hydrocarbon producing trend of major areal extent. The reservoir rock is a very fine to fine-grained feldspathic sandstone to litharenite. Core analyses and petrographic studies demonstrate that the reservoir has relatively good porosity for a Cretaceous Western Interior Seaway sandstone. However, in situ chemical weathering of common to abundant rock clasts, feldspar, and mafic minerals has resulted in the chemical precipitation of authigenic chlorite (and kaolinite) rinds which coat detrital grains. Minor kaolinite may have been precipitated directly from formation waters. The clay coatings on pore walls commonly join to form a partial restriction in the pore throats which accounts for the low permeability measurements obtained during core analysis and for the difficulty in predicting well performance from analysis of well logs. The reservoir rock has an average density of 2.68 g/cc due to the abundance of calcic feldspar, volcanic clasts, rock fragments, and heavy accessory minerals. Some intervals are calcite cemented and contain minor dolomite but have little or no authigenic clay coating the detrital grains; therefore, the carbonate cement is interpreted to be an early diagenetic event which preceded precipitation of the chloride and kaolinite. Migration of oil and gas into the reservoir was a relatively late event.

5923 Trapping mechanisms for oil in Lower Cretaceous Muddy sandstone at Recluse field, Wyoming. Berg, R.R. pp 261-272 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Muddy sandstones form lenticular reservoirs that contain water at both the up-dip and down-dip margins. As in many other stratigraphic traps, oil is produced in the central part of the reservoir where permeability is higher, whereas only water occurs at the margins where permeability is reduced. Consequently, wells that produced oil at the rate of 1800 bbls per day were offset by tests that recovered water at the rate of 1800 bbls per day from the same sandstone and at the same elevation. The principal Muddy reservoirs are of two types. One is a narrow, sinuous, fluvial sandstone body of limited extent. The other is a fine-grained sandstone that was deposited close to the shoreline during a marine transgression, and this sandstone forms wider, ovate bodies parallel to strike. In the latter section, grain size and quartz content decrease upward while clay matrix and bioturbation increase upward. Similar changes occur laterally so that permeability is reduced from an average 400 md to 17 md or less at the margins of the field. Lateral changes within the reservoir are confirmed by interpretation of logs and cores, and by analysis of shut-in pressures from drill-stem tests. The distribution of oil and water within the reservoir can be accounted for by capillary-pressure and potentiometric gradients. The observed oil column is somewhat greater than 130 ft. Calculations show that about 20 ft was trapped by capillary-pressure changes where permeability is reduced, and 110 ft was trapped by down-dip hydrodynamic flow. These calculations explain the recovery of water adjacent to oil production and suggest that fluid pressure relationships should not be neglected in either exploration for or development of stratigraphic traps.

DRILLING AND PRODUCTION

REFER ALSO TO CITATION(S) 5912

5924 (COO—4207-12) Pilot demonstration-enhanced oil recovery by micellar-polymer waterflooding Bell Creek Field. Monthly technical progress report, June 1977. (Gary Operating Co., Englewood, Colo. (USA)). 10 Jul 1977. Contract EF-77-C-02-4207. 8p. Dep. NTIS, PC A02/MF A01.

A report is presented covering the activities undertaken by Gary Operating Company, as well as by the major subcontractors, Atlantic Richfield, Union, and Intercomp. The major activity at this time is Phase II, Task 1, the Micellar-Polymer Systems selection from the two competing designs being developed by Atlantic Richfield and Union Oil. This activity comes to closure with Decision Point 2 in August.

5925 (ORO/5302—8) Tertiary oil recovery by CO_2 injection. Monthly report, March 1977. Conner, W.D. (Columbia Gas Transmission Corp., Charleston, W.Va. (USA)). 1977. Contract EF-76-C-05-5302. 26p. Dep. NTIS, PC A03/MF A01.

Progress is reported in field tests to evaluate and demonstrate the effectiveness of using CO_2 injection to recover high gravity crude oil from shallow watered-out reservoirs. The estimated recovery potential from the flood pattern of six (6) acres is approximately 50,000 barrels. The work will be conducted in five (5) phases as follows: Phase 1—preliminary testing and construction water injection, and plant construction, Phase 2—natural gasoline injection, Phase 3—CO_2 injection, Phase 4—carbonated water injection, and Phase 5—water injection. Injection of CO_2 was resumed in all wells on March 8, and adjusted to obtain a better balance in the pattern than had been experienced previously. Bottom hole pressure tests and production increases indicate that an almost immediate response was obtained once CO_2 injection was resumed. Through March 31, the injection phase of the project was approximately 82 percent complete. Additional production, due to CO_2 injection, through March 31, 1977, is approximately 3,970 bbls.

5926 Steam injection apparatus and method. Tafoya, V.G. (to Union Oil Co. of California). US Patent 4,046,199. 6 Sep 1977. Filed date 6 Jul 1976. 6p.

An apparatus and method for directing steam into selected strata of a relatively thick subterranean formation penetrated by a well. The apparatus includes an elongated housing attachable to the lower end of the well tubing, the housing having a closed lower end and a plurality of jets spaced around the sidewall thereof so as to be positioned opposite the strata to be treated. The jets directed the steam outwardly and downwardly against the formation face, causing it to preferentially enter the selected strata.

5927 Secondary oil recovery process. Brown, A.; Hager, S.F.; Chichakli, M.; Wu, C.H. (to Texaco Inc.). US Patent 4,046,196. 6 Sep 1977. Filed date 18 Mar 1976. 6p.

Oil is recovered from an oil-bearing subterranean formation penetrated by an injection well and a production well by injecting into the formation via the injection well a solution of a normally solid polymerized methacrylate and oil displaced by the injected solution is recovered from the formation via the production well. Optionally, after the solvent solution has been injected, a hydrocarbon slug such as crude oil, petroleum distillate, a soluble oil composition, etc. may be injected and, if desired, this may be followed by injection of water.

5928 Alkoxylated asphalt as sacrificial agents in oil recovery processes. Kudchadker, M.V.; Walker, T.O. (to Texaco Inc.). US Patent 4,043,396. 23 Aug 1977. Filed date 16 Jun 1976. 8p.

A process for producing petroleum from subterranean formations is disclosed wherein production from the formation is obtained

by driving a fluid from an injection well to a production well. The process involves injecting into the formation via the injection well an aqueous solution of alkoxylated asphalts as a sacrificial agent to inhibit the deposition of surfactant and/or polymer on the reservoir matrix. Normally the process would be carried out by first injecting the alkoxylated asphalts into the formation through the injection well and following them with either a polymer or a surfactant solution.

5929 Carbon-dioxide-assisted production from extensively fractured reservoirs. Offeringa, J. (to Shell Oil Co.). US Patent 4,042,029. 16 Aug 1977. Filed date 9 Jan 1976. 10p.

In an oil reservoir which is extensively fractured, the amount of oil recovered is increased by forming gaseous and liquid layers within the fracture network, flowing gaseous CO_2 into the gaseous layer, and producing liquid which contains oil from the liquid layer. The rates and locations of those injections and productions are correlated to keep the interface between the gaseous and liquid layers at selected depths.

5930 Method for initiating an in-situ recovery process by the introduction of oxygen. Pusch, G.; Klatt, H.J.; Froehlich, W. (to Deutsche Texaco AG). US Patent 4,042,026. 16 Aug 1977. Priority date 8 Feb 1975, German, Federal Republic of (F.R. Germany). 6p.

A method for starting a process to recover energy raw materials from a subterranean formation whereby igniters are injected into the upper region of the formation and inert gas is injected into the lower region of the formation, and thereafter an oxygen-containing gas is injected at a predetermined oxygen concentration and rate to initiate combustion, followed by increasing the oxygen concentration and/or rate of the injected gas to a maximum value.

5931 Oil recovery by viscous waterflooding. Savins, J.G.; Burdyn, R.F.; Waite, J.M. (to Mobil Oil Corp.). US Patent 4,042,030. 16 Aug 1977. Filed date 24 May 1976. 24p.

Waterflooding process for the recovery of oil in which at least a portion of the injected water is thickened by the addition of a sulfonate surfactant and a C_5—C_6 aliphatic alcohol having a hydrocarbon chain link of at least 3 carbon atoms. The action of the surfactant-alcohol system in increasing the viscosity of the water varies with the monovalent salt salinity of the water and the ratio of the amount of the sulfonate surfactant to the sum of the amounts of the sulfonate surfactant and alcohol in the water. A relatively viscous aqueous mobility control slug containing a sulfonate-alcohol system as previously described may be preceded by an aqueous surfactant slug. The aqueous solution of sulfonate surfactant and alcohol may be formulated and then aged for a time to allow the development of viscosity prior to injection into the oil reservoir. This viscosity development may be accelerated by heating.

5932 Methods of consolidating incompetent subterranean formations using aqueous treating solutions. Anderson, B.W.; Bowles, B.K.; Murphey, J.R.; Totty, K.D.; Young, B.M. (to Halliburton Co.). US Patent 4,042,032. 16 Aug 1977. Filed date 2 Oct 1975. 32p.

Methods of consolidating incompetent subterranean formations are provided whereby aqueous treating solutions are utilized to condition the formation, to carry a hardenable organic consolidating fluid into the formation and/or to carry particulated solids coated with a hardenable organic consolidating fluid into the formation and to cause the organic consolidating fluid to harden whereby a hard permeable mass is formed in the formation which prevents the undesirable movements of loose or incompetent sands therein.

5933 Plugging subterranean earth formations with aqueous epoxy emulsions containing fine solid particles. Knapp, R.H. (to Shell Oil Co.). US Patent 4,042,031. 16 Aug 1977. Filed date 12 Aug 1976. 12p.

Openings such as the pores of a permeable subterranean earth formation are plugged by inflowing a slurry of fine solid particles suspended in an aqueous emulsion that contains a dispersed oil-phase solution of a polyepoxide, an aminosilane, and a tertiary nitrogen-containing amine which is capable of causing the polyepoxide to polymerize while causing the particles to become oil-wet.

5934 Recovery of oil by circulating hot fluid through a gas-filled portion of a network interconnected fractures. Offeringa, J. (to Shell Oil Co.). US Patent 4,040,483. 9 Aug 1977. Filed date 9 Jan 1976. 12p.

The recovery of oil from an oil-bearing formation which contains a network of interconnected fractures is improved by circulating a hot heat-exchanging fluid through gas-containing portions of the fractures while producing oil from liquid-containing portions of the fractures.

5935 Technique of search-survey studies in the Red-Lenin Dome (western Siberia). Klimushina, L.P.; Guseva, A.N.; Kozhevnikova, S.D. pp 25-34 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

Search drilling in the Red-Lenin Dome was carried out in 1956 by a method of successive drilling of small local uplifts. Consequently the problem of the presence of a single oil deposit for the whole dome has not been resolved up to now. The results of search-survey studies justify the significance of oil-bearing content in the jurassic complex as compared with the cretaceous. It is proposed in search drilling studies that first the oil-bearing content of the jurassic sediments of the dome be estimated as a whole by marking out extended profiles of wells across the dome axis, and second that zones be tested having higher faulting, which zones control the distribution of maximum amounts of oil and extractable reserves. 2 tables, 1 fig., 8 refs. (SJR)

5936 Kiehl field. Arro, E. (Burlington Northern, Inc., Billings, MT). pp 121-123 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Kiehl field is located about 1½ miles south of Deadman Creek field and covers portions of sections 30 and 31. T. 53 N., R. 67 W. Three dry holes (SE¼ NW¼ sec. 30, SE¼ NE¼ sec. 31 and NE¼ SW¼ sec. 31) were drilled in the Kiehl area prior to the field discovery. Two of these are now 80 acre offsets to the present field limits. The Lotus Petroleum well in NE¼ SW¼ section 31 was plugged after testing 5438 feet of sulfur water with some oil scum from Minnelusa lower "B" sand; this well also had a thin, 68-foot Opeche zone. The Lotus well eventually led to the drilling of an updip location resulting in the Kiehl field discovery. Oil production from the Minnelusa lower "B" sand has been fully defined at Kiehl field with 5 producers and 4 dry holes. The field has a partial water drive although production is chiefly by fluid expansion.

5937 Spearhead Ranch Field. Lange, A.U. (Mountain Fuel Supply Co., Denver). pp 175-178 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Data and information on the field concerning operators, field status, well characteristics, production, and reservoir parameters are tabulated. (JRD)

5938 Trabing Field. Lange, A.U. (Mountain Fuel Supply Co., Denver). pp 179-186 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Trabing Field is located in southern Johnson County, Wyoming, approximately 28 miles southeast of the town of Buffalo and 14 miles northeast of the town of Kaycee. It is also seven miles north of Reno Field and 17 miles southeast of the Billy Creek Gas Storage Field. Although the area is along the western edge of the Powder River Basin, both Reno and Trabing Fields are east of the basin's synclinal axis. Trabing Field produces gas and high gravity oil from a stratigraphic trap in the Billy Creek sandstone of the Frontier Formation. The accumulation was discovered by combining surface and subsurface data and projecting the information into the Trabing area of the Powder River Basin, and by the follow-up of a multi-well drilling program. In the future, as knowledge through data interpretation expands, more offshore marine bars like the Billy Creek sandstone will be found and hopefully they will contain hydrocarbons in commercial quantities.

5939 Steinle Ranch Field. Reid, S.G. (Runge and George, Casper, WY). pp 187-192 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

The geology of the oil and gas productive Muddy "A" sand in the Steinle Ranch Field is described. The pool is classified as a stratigraphic trap. The reservoir is an isolated pod of sand filled with oil and gas. It is part of a trend of offshore bars that produce oil and gas in Big Hand, Hilight, Porcupine, and Haps Draw Fields. The reservoir sand was deposited as an offshore bar during eastward transgression of the shoreline. The field contains twenty wells on 160 acre well-spacing which through December, 1975, had produced 2.1 million barrels of oil and 2.6 billion cubic feet of gas. A secondary water flood project has been initiated, however, results are inconclusive to date. Estimated ultimate recoverable reserves should be 4.5 million barrels of oil and over 5.6 billion cubic feet of gas.

5940 Statistical summaries of Muddy and Minnelusa reservoirs in the Powder River Basin, Wyoming. Basko, D.; Mulholland, E.E. (Wyoming Oil and Gas Conservation Commission, Casper, WY). pp 273-275 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Tables of data on well spacing reservoir rock porosity, connate water, reservoir volume, and anticipated recoveries are presented. It is noted that 31 small Muddy and Minnelusa formation oil fields with 756 wells spaced primarily on 80-acre drilling and spacing units have produced almost 200 million barrels of oil and will continue to produce for many years to come. (JRD)

5941 Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. (Control of exploitation processes for petroleum deposits). Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). 244p. (CONF-7410169—).

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

Papers are compiled on the following subjects: status of problems in the control of development of petroleum deposits using waterflooding, principles and methods for controlled enhanced recovery processes under different physical-geological conditions, reduction of water recovery, and increase of the engineering-economic indications for petroleum recovery. Abstracts were written for selected papers.

5942 Problems, principles, and methods of controlling the process of development of petroleum deposits during the displacement of petroleum with water. Baishev, B.T. pp 7-14 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The basic purposes of controlling the development processes are formulated. The control principles is discussed and a formulation of the basic principles is proposed. Control methods are classified and the technological efficiency of some of them is discussed.

5943 Control of the exploitation of sharply separated multistrata and zonally inhomogeneous field by modification of the flooding system. Ashirov, K.B.; Gubanov, A.I.; Sazonov, B.F. pp 15-29 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

Methods of controlling the development of multistrata inhomogeneous petroleum deposits by amplifying the waterflooding systems in zones with low permeability were examined. Good production of less permeable zones of the strata and its individual seams is realized by supplementary cuts in the deposit, organization of focussed flooding, drilling supplementary delivery wells, and split injection of the water. One extremely efficient method is proposed: method of inversion of the staged flooding system making it possible to increase the range of productivity with the flooding.

5944 Control of the process of exploitation of multistrata petroleum deposits with base water. Orlinskii, B.M.; Knyazev, S.V.; Lysenko, V.D.; Mukharskii, E.D. pp 30-39 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The characteristics of the geological structure of the water-petroleum zone of large multistrata deposits are examined. Recommendations are made on the separation of the water-petroleum zone, differentiation of the original petroleum reserves, and analysis of the status of its development. A nomogram is given for the calculation of the engineering indicators. Proposed methods for the exploitation of the water-petroleum zone and determination of the geological structure and degree of its hydrodynamic bonds with the upper and lower horizons of the reservoir are given. Measures for increasing and controlling the production processes are recommended.

5945 Control of the process of oil field development. Baturin, Yu.E.; Kukosh, T.G.; Lugovaya, V.M. pp 40-47 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The problems and purposes of controlling the processes of oil field development are formulated. A general solution is given to two problems: determination of the magnitude of floodability, a detached series of wells during inter-contour flooding and determination of the optimum capacity of working over of the outer series of wells during transcontour flooding. The necessity of creating injection regulators in injection wells is shown.

5946 Control and regulation of the development of a multistrata oil field (using petroleum deposits of western Siberia as an example). Kanalin, V.G. pp 48-55 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

An analysis is made of the basic control methods in the development of oil fields. Recommendations are made on the use of these methods for controlling the processes in the development of oil fields in western Siberia.

5947 Control of the processes of development of the petroleum deposit of the IV horizon of the Anastasiev—Troitsk deposit under conditions of active reversible pressure. Amelin, I.D.; Bragin, V.A.; Bichkevskii, A.D.; Burchevskii, L.V.; Ishkhanov, V.G.; Konev, V.D.; Lyadkin, V.Ya. pp 56-67 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The basic principles of controlling the development of oil deposits are formulated. Using the development of the petroleum deposit of the IV horizon of the Anastasiev-Troitsk deposit as an example, the adoption of these principles for achieving the maximum ultimate coefficient of petroleum recovery is shown.

5948 Method for the determination of the rational limits of floodability of production wells under conditions of development of the deposit by displacement of the petroleum with water. Vasil'evskii, V.N. pp 68-75 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

An approximation method is given for the determination of the rational limits of floodability of production wells. The method is based on the solution of a system of iteration equations between the examined real well and conditional well, equivalent to its effect on all examined systems of effective wells of the given region. The ways of using the method for solution of practical problems of controlling the development of petroleum deposits by waterflooding are given.

5949 Modification of the direction of fluid flow: method for controlling the process of development during flooding of inhomogeneous strata. Surguchev, M.L.; Bocharov, V.A.; Gavura, V.E.; Atanov, G.A. pp 76-85 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov,, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The results of increasing the efficiency of waterflooding petroleum deposits by creating in the stratum non-stationary processes of displacement by modifying the direction of the filtrating flow were reported. The results of calculating from the basic engineering indicators the development during modification of the direction of displacement were given for homogeneous and zonally inhomogeneous strata. The results of adopting the method of modifying the

direction of the filtrating fluid in the A_4 and B_2 strata of the Pokrovsk deposit were discussed.

5950 Optimum control of the development of oil fields. Meerov, M.V.; Litvak, B.L.; Valikhanov, A.V; Bulgakov, R.T.; Bershanskii, Ya.M. pp 86-92 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov,, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

A solution is reported for the problem of optimization of the development of oil fields, guaranteeing the maximum recovery of petroleum during all periods of development and minimum recovery of water with maintenance of the engineering and economic limitations. Algorithms and computer programs are proposed which make it possible to solve the problems of establishing the optimum development regime with respect to wells and with respect to the stratum as a whole. The results of experiments carried out in October 1972 on the optimum control of the development of the Tashliyarsk area of the Romashinsk deposit were described.

5951 Optimum control with respect to energy criteria by a regime of production and injection wells. Shvidler, M.I.; Baishev, B.T.; Gokhman, M.V. pp 93-107 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov,, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The problems of optimization of the energy loss in a system of strata-wells are examined for the following cases: (1) one-phase flow in non-homogeneous strata; (2) flow of expanding fluids in homogeneous strata; (3) piston displacement in complex strata system; and (4) two-phase flow in non-homogeneous strata. Algorithms and calculation examples are reported.

5952 Problems of optimization in petroleum recovery. Chugunov, V.D.; Korotkov, S.F. pp 108-117 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov,, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

A formulation is given of the general problem of optimization in petroleum recovery and means are given for its solution by the method of mathematical programming.

5953 Two-stage drilling as a means of increasing petroleum recovery and development of the possibilities of regulating waterflooding processes. Borisov, Yu.P. pp 118-122 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The principal means of increasing petroleum recovery and possibilities of controlling the process of development of petroleum deposits during waterflooding by drilling in two stages are discussed. The two stages of drilling are the original production wells and the supplementary reserve wells.

5954 Selection of oil fields and the principles of systems of developing multistrata deposits. Sattorov, M.M.; Baimukhametov, K.S.; Buskunov, A.A.; Trit'yakova, G.I.; Tazetkinov, R.K. pp 123-133 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

A more precise definition of the concept of "object of development" is given and a proposal is made to introduce the concept "elementary object of development." It is shown that for the characteristics of both elementary and complex objects of development it is necessary to use a larger number of parameters than are currently in use. Methods of further improvement of the methods of calculating the engineering indicators for the development of multistrata deposits are reported.

5955 Problems in increasing petroleum recovery. Mukhametzyanov, F.M.; Fatykhov, A.G.; Galeev, R.G. pp 134-145 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

Problems in selecting the optimum combination of wells, transferrable into injection wells for a selective system of waterflooding, are examined. The effect of the hydrodynamic coherence on the maximum recovery from multistrata deposits and the problem of the rational distribution of wells with consideration of the transfer of production wells into injection wells are also discussed.

5956 Control of the advance of formation water with foam. Amiyan, V.A.; Vasil'ev, V.K.; Ivanov, P.A.; Maslov, I.I.; Makhmutov, N.P.; Pospelova, V.P. pp 146-154 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

Two-phase and three-phase foams, used for controlling the advance of formation water, were examined. The results of laboratory investigations of the stability of foam, its rheological characteristics, and conditions for the adhesion of the foam bubbles to the surface of porous media were discussed. The results of tests on the oil fields of Bashkir and the Krasnodarsk Territory were reported. The necessary instrumentation for carrying out the full-scale tests on controlling the advance of formation water with foam was described. As a result of these tests the floodability of production wells was reduced an average of 30 percent, the petroleum output increased 1.5 times, and the duration of the effect lasted for six months.

5957 Singularities of waterflooding petroleum deposits, confined to finely alternating strata, and its effect on petroleum recovery (using the Novodmitrievsk deposit as an example). Garushev, A.R.; Ishkhanov, V.G.; Bichkevskii, A.B.; Azhnov, V.G.; Chernov, B.S. pp 155-163 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

By using the development of the Novodmitrievsk deposit which has a complex geologic-physical characteristics of the reservoir, as an example, the singularities of waterflooding, its efficiency, and the necessity of continued control and regulation of the degree of coverage in order to increase the ultimate coefficient of petroleum recovery were shown. The introduction of control by geophysical methods (neutron logging and thermometry) of the degree of coverage through the thickness of the productive strata made it possible to distinguish the strata with respect to the character of the saturation, to determine the degree of production of the seams, and to segregate the petroleum-saturated and waterflooded thicknesses.

5958 Simultaneous-discrete exploitation of two and more strata of one well as a means of regulating the process of development of a deposit. Vorob'ev, V.D.; Dergunov, P.V.; Kuz'min, V.M.; Stepanov, V.P.; Tkalenko, R.A. pp 164-175 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

Solutions of the hydrodynamic problem on the basis of which methods were obtained for the evaluation of the efficiency of joint operation and for the determination of the moment of time for affecting the strata (transfer of the well into simultaneous-discrete operation) were reported. Examples were given. Questions on the economic basis of the expediency of the simultaneous-discrete operation methods and methods for the determination of the effectiveness of their use were examined. As an evaluation of the efficiency, economic indicators of the recovery of petroleum from the basic period of development, particularly supplementary recovery of petroleum, supplementary volumes of injected water, and decrease of the capital and operational expenses were proposed.

5959 Limitation of the influx of water into petroleum wells (status and perspective methods). Usachev, P.M.; Sidorov, I.A.; Galybin, A.M.; Kazakova, A.V.; Sazonova, V.M. pp 176-186 of In

Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

An analysis is made of the isolation operations carried out in 1972-73. The reasons for the low efficiency of the operation during limitation of the influx of the base and injected water were determined. A hydrodynamic analysis was made of the flow process after the isolating operation. Sediment formation in porous media, occurring during injection of selective materials, was studied under laboratory conditions.

5960 Status and perspective use of processes for the displacement of petroleum by miscible agents during development of a deposit. Degtyarev, N.M. pp 187-192 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The present status and future development of petroleum displacement processes using miscible agents for enhanced petroleum recovery is evaluated. The processes are examined as links of complex methods for the very rational exploitation of natural resources of petroleum and gas. The trends of laboratory and industrial studies are summarized and basic conclusions and recommendations are reported.

5961 Combined displacement of petroleum with water and gas. Liskevich, E.I. pp 205-210 of In Regulirovanie protsessov ekspluatatsii neftyanykh zalezhei. Borisov, Yu.P. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

From Training session of scientific council on problems of development of petroleum depostis of USSR and control of exploitation processor of petroleum deposits; Krasnodar, Union of Soviet Socialist Republics (USSR) (1 Oct 1974).

See CONF-7410169—.

The results of laboratory tests on the displacement of petroleum by the combined effects of gas and water applied to strata under the reservoir conditions of the Samotlorsk and Bitkovsk deposits were reported. The experiments were carried out on linear cylindrical models of the strata with maximum approximation to the reservoir conditions with respect to reservoir pressure and temperature, reservoir fluids, and natural porous media.

PROCESSING

REFER ALSO TO CITATION(S) 6114

5962 Means for controlling a solvent refining unit. Woodle, R.A. (to Texaco Inc.). US Patent 4,053,744. 11 Oct 1977. Filed date 7 Oct 1976. 16p.

A solvent refining unit is controlled so that it has a maximum allowable solvent flow rate or a maximum allowable extract oil flow rate. The temperature of the extract-mix in the refining tower, the flow rate of the charge oil, the flow rate of the solvent, and the flow rate of the extract oil are sensed by sensors which provide corresponding signals. A circuit provides signals corresponding to desired flow rates for the charge oil and the solvent and for a desired temperature for the extract-mix in the refining tower. The refining unit is operated in accordance with the desired signals so as to achieve either a maximum allowable flow rate for the solvent or a maximum allowable flow rate for the extract oil, or a maximum allowable flow rate for the refined oil, or a reduced charge oil flow rate for a fixed refined oil flow rate.

5963 Aromatic hydrocarbon separation via solvent extraction. Asselin, G.F. (to UOP Inc.). US Patent 4,046,676. 6 Sep 1977. Filed date 22 Apr 1976. 12p.

A solvent extraction process for separating polar hydrocarbons from non-polar hydrocarbons is claimed. The solvent-rich extract phase from the extraction zone is introduced into a stripping column. The stripper bottoms, being a polar hydrocarbon-containing, solvent-rich stream is introduced into an upper portion of a solvent recovery column. A first vaporous stripping medium is introduced into a lower portion of the solvent recovery column. A first solvent-rich stream, virtually free from hydrocarbons, is withdrawn as a bottoms product and recycled to the extraction zone, while a hydrocarbon-containing, side-cut second solvent-rich phase is withdrawn and introduced into the stripping column in admixture with the extract phase. At least a portion of one of the first and second solvent-rich streams is commingled with the fresh feed for introduction therewith into said extraction zone. A relatively minor proportion of the first solvent-rich stream is introduced into a solvent regenerating zone, therein contacting a second vaporous stripping medium. Regenerated solvent, containing substantially all of the second stripping medium is introduced into said recovery column as at least a portion of said first stripping medium.

5964 Aromatic hydrocarbon separation via solvent extraction. Asselin, G.F. (to UOP Inc.). US Patent 4,046,675. 6 Sep 1977. Filed date 22 Apr 1976. 12p.

A solvent extraction process for separating polar hydrocarbons from non-polar hydrocarbons is claimed. The solvent-rich extract phase is introduced into a stripping column, the bottoms from which, a polar hydrocarbon-containing, solvent-rich stream, is introduced into an upper portion of a solvent recovery column. A vaporous stripping medium is introduced into a lower portion of the solvent recovery column. Polar hydrocarbons in concentrated form are recovered as an overhead stream. A solvent-rich stream, virtually free from hydrocarbons, is withdrawn as a bottoms product and recycled to the extraction zone, while a hydrocarbon-containing side-cut solvent-rich phase is withdrawn and introduced into the stripping column with the extract phase.

5965 Hydrocarbon conversion with an acidic multimetallic composite. Pollitzer, E.L.; Hayes, J.C. (to UOP Inc.). US Patent 4,046,672. 6 Sep 1977. Filed date 20 May 1976. 28p.

Hydrocarbons are converted by contacting them at hydrocarbon conversion conditions with an acidic multimetallic catalytic composite comprising a combination of catalytically effective amounts of a platinum group component, a tin component, a cobalt component, and a halogen component with a porous carrier material. The platinum group, tin, cobalt and halogen components are present in the multimetallic catalyst in amounts respectively, calculated on an elemental basis, corresponding to about 0.01 to about 2 wt. % platinum group metal, about 0.01 to about 5 wt. % tin, about 0.1 to about 5 wt. % cobalt, and about 0.1 to about 3.5 wt. % halogen. Moreover, the catalytically active sites induced by these metallic components are uniformly dispersed throughout the porous carrier material and these components are present in the catalyst in carefully controlled oxidation states such that substantially all of the platinum group component is in the elemental metallic state, substantially all of the catalytically available cobalt component is in the elemental metallic state or in a state which is reducible to the elemental metallic state under hydrocarbon conversion conditions or in a mixture of these states, while substantially all of the tin component is present therein in an oxidation state above that of the elemental metal. A specific example of the type of hydrocarbon conversion process disclosed is a process for the catalytic reforming of a low-octane gasoline fraction wherein the gasoline fraction and a hydrogen stream are contacted with the acidic multimetallic catalyst disclosed herein at reforming conditions.

5966 Process for removing arsenic from hydrocarbons. Young, D.A. (to Union Oil Co. of California). US Patent 4,046,674. 6 Sep 1977. Filed date 25 Jun 1976. 16p.

A process for removing arsenic from a mineral oil feedstock containing at least 2 ppmw arsenic comprises contacting said feedstock at elevated temperatures with a catalytic absorbent comprising a nickel sulfide and a molybdenum sulfide composited with a refractory oxide, said nickel sulfide and said refractory oxide each being present in relatively large proportions. Under preferred conditions a product oil stream containing less than 2 ppmw arsenic is continuously obtained from said contacting until a weight of arsenic at least equivalent to that of the nickel in the catalytic absorbent has been absorbed thereon.

5967 Hydrocarbon catalytic cracking process. McKinney, J.D.; Mitchell, B.R. (to Gulf Research and Development Co.). US Patent 4,040,945. 9 Aug 1977. Filed date 2 Jan 1976. 8p.

An improved hydrocarbon catalytic cracking process comprises introducing tin into the cracking zone so as to maintain a volume ratio of carbon dioxide to carbon monoxide in the gaseous effluent from the catalyst regeneration zone of at least 3.0.

PRODUCTS AND BY-PRODUCTS

5968 Gasoline production. Kemp, J.D.; Sieg, R.P. (to Chevron Research Co.). US Patent 4,046,520. 6 Sep 1977. Filed date 9 Jun 1975. 10p.

A process is claimed for producing a high-octane gasoline having reduced smog-forming tendencies, which comprises: thermally dehydrogenating-cracking isobutane to obtain propylene and isobutene; hydrating propylene to obtain isopropanol; etherating the isopropanol with the isobutene to obtain t-butyl isopropyl ether; and blending the t-butyl isopropyl ether with gasoline-boiling-range hydrocarbons. Preferably the thermal dehydrogenation is carried out under conditions, specifically including a temperature between about

1125° and 1275°F., to produce a molar ratio of isobutene to propylene between 1.0 and 1.25.

5969 Process for the production of a petroleum coke and coking crystallizer used thereof. Hayashi, K.; Nakaniwa, M.; Kobayashi, N.; Yamamoto, M.; Hase, Y. (to Maruzen Petrochemical Co., Ltd.). US Patent 4,040,946. 9 Aug 1977. Priority date 26 Sep 1974, Japan. 16p.

A petroleum coke of unusually high-crystalline texture and of high purity is produced from a low-sulfur petroleum material by a process including a preheat-treating step for removing non-crystalline substances contained in the material as pitch or coke and a coking step wherein a heavy oil derived from the preceding step is coked in a coking crystallizer in such a manner that pitch-like heavy oil downwardly flows and is progressively accumulated and coked therein while gaseous light hydrocarbons are discharged at the upper part of crystallizer whereby the coking is conducted with a high growth and high orientation of coke crystals formed.

5970 Bituminous emulsions for highway pavements. Washington, DC; Transportation Research Board (1975). 86p. .

A discussion is presented on the state-of-the-art of the use of emulsified asphalts for construction and maintenance of the various types of pavements and surface applications. Because emulsified asphalts are becoming of greater importance in the partial solution of energy and environmental problems associated with the use of other bituminous materials, the advantages and disadvantages of using emulsions as replacements are discussed. The development of emulsions, specifications, and test methods, and the apparent need for additional grades of emulsions and new test methods, are reported. Mix design and structural design methods that apply to emulsion base and surface courses are presented. Construction methods and equipment that may be unique to the use of emulsions are reviewed. The need for training technicians and engineers in the selection, use, and control of emulsion applications, as well as proposed future training, is discussed. A glossary of terms is included. (JRD)

HEALTH AND SAFETY

5971 Cancer mortality in U.S. counties with petroleum industries. Blot, W.J.; Brinton, L.A.; Fraumeni, J.F. Jr.; Stone, B.J. (National Cancer Inst., Bethesda, MD). *Science;* **198**: No. 4312, 51-53(7 Oct 1977).

A survey of cancer mortality from 1950 to 1969 was conducted in U.S. counties where the petroleum industry is most heavily concentrated. Male residents of these counties experienced significantly higher rates for cancers of the lung, the nasal cavity and sinuses, and the skin (including malignant melanoma) compared to male residents of counties with similar demographic characteristics. Further study is needed to determine whether these patterns result from exposure to chemical carcinogens, including polycyclic hydrogens, involved in the manufacturing of petroleum.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 6852, 6958

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 7390, 7428, 7429, 7446

5972 Oil recovery apparatus. in't Veld, C. (to National Marine Service, Inc.). US Patent 4,053,414. 11 Oct 1977. Priority date 26 Nov 1975, Netherlands. 8p.

A marine vessel is provided with a closed tank for gravity separation of oil and water. A boom extending laterally from the vessel sweeps the surface of a body of water on which the vessel floats and a skimmer associated with the boom skims surface oil and some water into a conduit leading to a manifold extending around the upper inner periphery of the tank. The manifold discharges upwardly into the tank through a multiplicity of ports, the tank preferably being completely filled with oil and/or water. Separated water is withdrawn from the bottom of the tank through a plurality of coalescing filters having large exposed coalescer screens. Hoods over the coalescers direct flow thereto to ensure uniform distribution of water and oil globules over their surfaces and direct coalesced oil toward the upper region of the tank in a concentrated stream. A pump withdraws the water from the tank and discharges it into the ambient water. Flow produced by the pump can be reversed for backwashing the coalescers. A detector in the tank senses the level of the interface between separated water and oil, and when that interface reaches a predetermined lower level flow in the separator, it is interrupted, after which flow is reversed until the interface rises to a desired upper level.

5973 Cable connector assembly for oil containment boom. Preus, P. US Patent 4,045,962. 6 Sep 1977. Filed date 2 Jul 1976. 4p.

A barrier for water-carried pollutants consists of a series of end-to-end connected boom sections with each boom section including a tubular sleeve portion containing flotation means and a depending skirt. The entire series of boom sections are connected to one or a pair of flexible draft members which are connected to the booms at spaced points by connector assemblies comprising this invention.

5974 Oil slick retaining boom for off-shore oil wells. Sessions, B.J. US Patent 4,043,131. 23 Aug 1977. Filed date 9 Apr 1976. 4p.

An oil-retaining boom structure for disposition upon a body of water, preferably surrounding an off-shore oil well has a plurality of bouyant float members movably connected together by a connecting cable which extends through the body structure of each float member. Each float member comprises an elongate housing having weights disposed in one end thereof adapted to retain that housing end downward in the water. The floats are interconnected with each other through the connecting cable with washer means surrounding the cable between the adjacent floats. The washer means preferably have grooved means surrounding the circumference of the washer to accommodate elongate rods which can be used to retain portions of the boom in parallel relationship if desired to form a channel for the oil within the boom. The floats have sheet means attached to at least one side thereof extending along the boom to retain the oil on one side of the sheet means as the boom rides at or near the surface of the water.

5975 Method for conditioning fresh and sea waters from oil. Marconi, W.; Oddo, N.; Degen, L. (to Snam Progetti, S.p.A.). US Patent 4,042,495. 17 Aug 1977. Priority date 13 Apr 1973, Italy. 4p.

Oily hydrocarbons which pollute the surface of water are removed therefrom by scattering over the polluted surface solid particles of nutrient salt containing nitrogen and phosphorous in a form that is readily assimilable by aqueous microorganisms capable of metabolizing hydrocarbons. The particles of nutrient salt are given a surface pretreatment with paraffin so that they are buoyant and only slowly soluble in water and lipophilic.

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 5979, 6852, 6947, 6958

5976 (NP—22430) **Effects of Federal price and allocation regulations on the petroleum industry. Staff report to the Federal Trade Commission.** Roush, C.T. Jr. (Federal Trade Commission, Washington, D.C. (USA). Bureau of Economics). Dec 1976. 99p. GPO.

An economic analysis is presented of the operation and effects of controls on the petroleum industry in effect prior to the passage of the Energy Policy and Conservation Act (PL 94-163) of December 1975. Sections are included on effects of a single-price ceiling; effects of two-tier price controls, allocation among buyers under two-tier price controls in a noncompetitive market; viability of independents; burden of government controls; energy independence; and outlook for the future. (JRD)

TRANSPORT, PIPELINES, AND HANDLING

5977 Pipelining in need of more safety techniques. Freund, J. *Offshore;* **37**: No. 5, 354-355, 358-360, 362-363(May 1977).

Development of techniques for laying pipelines in deep storm-prone waters is described. Improved pipe laying barges are described along with improved pipe laying procedures, primary pipe joining, and structural analysis. (JRD)

5978 Problems of weldability of pipes for oil and gas pipelines. Rakhmanov, A.S. *Stroit. Truboprovodov;* No. 5, 16-17(1976). (In Russian).

The need to reconsider the factors in "weldability" has arisen owing to changes in recent years in pipeline construction. Installation of pipes in Siberia and the far north has increased greatly, where continuous-flow operations must be performed at temperatures as low as -50°C. Pipeline diameters have increased from 820 to 1020 to 1220 to 1420 mm. Pressure has also increased from 55 to 75 kg/cm^2. The diameter increase has significantly increased the wall thickness. In order to reduce metal consumption, high strength pipe steel is coming into increasing use. In the last ten years, the strength of pipes used in pipelines has increased by 15 percent, and further increases from 60 to 70 to 80 kg/mm^2 must be expected in the near future. Type 09G2S steel, 12 to 15 mm thick, can be welded without limitation as to welding mode, without heating at air temperatures down to -50°C, using broad range welding materials. Complications do not arise in the production of joints satisfying the requirements of the construction norms and rules, and practice has confirmed the high practicality of these joints. It is considered that these steels have

good weldability. However, in order to weld the same steels in sheets thicker than 15 mm or dispersion-hardened steels of which larger diameter pipes are made, preliminary heating is required, as well as the use of special electrodes or a special layer beneath the seam to prevent cold spots at the root of the seam and other problems, that is these steels are of limited weldability. Type 17G2AF steel, now used for the manufacture of pipe at the Khartsyzsk Plant, has lower cold crack resistance than similar steels produced by other suppliers. An equally difficult problem is evaluation of the weldability of heat treated pipe with standard strength 72 kg/mm^2. The problems defined by the peculiarities of the physical processes in seam formation and the behavior of various joints under load must be solved.

STORAGE

5979 (NP—22425) **Strategic petroleum reserve plan: preliminary analysis.** Gleason, E.J. Jr. (Northeastern Legislative Energy Staff, Albany, N.Y. (USA)). 26 Jan 1977. 5p. Legislative Energy Staff, Albany, NY.

Some features of the Strategic Petroleum Reserve Plan are: a 500 million barrel storage capacity is envisioned; two, possibly three, types of crude oil and no refined products would be stored; and the reserve would be a centralized facility located in salt domes on the Gulf Coast, primarily in Texas and Louisiana. No regional storage is envisioned. Major problems of the Plan are discussed. (LK)

5980 **Underground installation for storing petrol products.** Hansson, B.; Svensson, S. (to Armerad Betong Vaegfoerbaettringar Aktiebalog). US Patent 4,045,963. 6 Sep 1977. Priority date 28 May 1975, Sweden. 4p.

The invention is connected with an installation or plant for storing oil and similar petrol products in several underground storing rooms each communicating with a common oil-filled pump chamber housing submersed pumps for pumping out oil from any of the rooms. Selective pumping requires valves for selective connection of room outlet pipes with a pump inlet pipe. Submersed location of those valves in the pump chamber, according to the prior art, involves several disadvantages such as the need of draining the complete system for repair and maintenance work on the valves, and, difficulty to remote-control the valves. These advantages are, according to the invention, eliminated by the use of a dry valve chamber sealed-off from the oil-containing pump chamber housing submersed pumps.

COMBUSTION

REFER ALSO TO CITATION(S) 6111

NATURAL GAS

REFER ALSO TO CITATION(S) 5887, 5888, 6957, 6960

RESERVES

REFER ALSO TO CITATION(S) 5890, 6886, 6959

GEOLOGY AND EXPLORATION

REFER ALSO TO CITATION(S) 5894, 5896, 5897, 5903, 5905, 5907, 5908, 5909, 5913, 5919, 5920, 5939, 5987, 5993

DRILLING, PRODUCTION, AND PROCESSING

REFER ALSO TO CITATION(S) 5937, 5938, 5939, 7205

PRODUCTS AND BY-PRODUCTS

5981 **Vessel having natural gas liquefaction capabilities.** Kniel, L. (to Lummus Co.). US Patent 4,041,721. 16 Aug 1977. Filed date 7 Jul 1975. 4p.

There is disclosed a vessel having natural gas liquefaction capabilities formed of a plurality of self-contained liquefaction assemblies, each of which being disposed in a separate liquefaction compartment.

5982 **Recovery of natural gas liquids by partial condensation.** Zahn, C.W.; Clayton, H.A. (to Phillips Petroleum Co.). US Patent 4,040,259. 9 Aug 1977. Filed date 22 May 1975. 8p.

In the recovery of natural gas liquids by partial condensation, flashing, and compression, minimum and maximum temperature control of partially condensed feed stream hydrocarbons to a product separator is imposed by a minimum temperature control system which provides the same set point to the pressure controllers on the compressor suction scrubbers for both the product and the flashed vapor produced from the liquid outlet of the product separator with one of the two output signals responsive to the pressure of the product suction scrubber or the flashed vapor suction scrubber manipulating, by way of a selective relay, the engine speed controller of the dual compressor unit taking suction from the two scrubbers; and a maximum temperature controller which controls the rate of by-pass of natural gas feed around the partial condensation-separation system unless, by means of a selective relay, compressor availability is a more limiting criterion.

HEALTH AND SAFETY

5983 (BERC/RI—77/1) **New Look at odorization levels for propane gas.** Whisman, M.L.; Goetzinger, J.W.; Cotton, F.O.; Brinkman, D.W.; Thompson, C.J. (Energy Research and Development Administration, Bartlesville, Okla. (USA). Bartlesville Energy Research Center). Sep 1977. 97p. Dep. NTIS, PC A07/MF A01.

Nearly 4,000 persons participated in a study to evaluate three odorant systems in four test modes and at 24 different test sites. Participants included trained panels, untrained ERDA employees, and several thousand untrained volunteer evaluators. The classical testing technique and three modified test modes were used to represent a spectrum of conditions that would define the effect of environmental familiarity and mental distractions upon olfactory responses to LP-gas. Significant efforts were directed toward determination of odorant levels that not only can be detected but also will be detected. The study showed that in addition to defects of the nasal anatomy, psychological factors also affect olfactory responses, and that unfamiliarity with a given environment as well as anxieties or mental distractions can produce reduced awareness to odorants intended to warn individuals of the presence of LP-gas. A second part of the study involved a laboratory determination of equilibrium K-values for both ethyl mercaptan and thiophane at three temperatures. Novel sample handling and gas chromatographic techniques provided reproducible results which were in close agreement with theoretical predictions. (28 tables, 29 tables)

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 6854, 6962

5984 (CONF-770144—1) **Natural gas acquisition.** Keplinger, H.F. (Keplinger and Associates, Inc., Tulsa, Okla. (USA)). 1977. 39p. and Associates, Inc., Houston, TX.

From Acquiring natural gas conference; Houston, Texas, USA (5 Jan 1977).

The natural gas supply situation in the U.S. is put into perspective. It is shown that, while intrastate gas was in plentiful supply the last few years, interstate gas-supplied states suffered curtailments and losses in jobs. Deregulation of natural gas prices is called for. The role of the end user is next discussed. Gas purchases from interstate pipeline companies are subject to curtailments. The end user can avoid this and secure his long-term energy supply needs by either purchasing gas at the wellhead, participating in exploration, or purchasing gas reserves in the ground. The advantages and disadvantages of each method are discussed. (DLC)

ENVIRONMENTAL EFFECTS

REFER ALSO TO CITATION(S) 7390

5985 (CONF-7609125—, pp 19p, Paper 7) **Determination of protection ranges for groundwater discharge areas with regard to gas mining.** Boehm, B.; Meyer, H.H. (Technische Univ., Hanover). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

Research results show there is a possibility of groundwater contamination from natural gas production. The present regulations of groundwater protection, which consider only the direction and

time of flow, do not offer a solution of the problem. A procedure was developed by which protection ranges with regard to gas production can be determined for a fixed residual groundwater contamination. The starting point for calculations is a net of stream and equipotential lines of the groundwater field. Then flow velocity and time of flow will be determined at every node on the flow net with the aid of an EDV-program. On basis of an analytical solution of the one dimensional dispersion equation, the permissible yield of harmful substance is calculated along the stream lines in relation to the known residue of groundwater contamination at the discharge point. This permits the determination of lines of equal source strength. These lines indicate at which distance from the discharge well a certain quantity of harmful substance could be infiltrated into the groundwater without exceeding the allowable critical concentration. Furthermore, the possible cases of groundwater pollution by gas production will be determined and the yield of dissolved substances coming to the groundwater stream will be calculated for the above mentioned cases. With these values and the appropriate lines of equal source strength it is possible to limit protection ranges for water discharge areas with regard to gas production.

ARTIFICIAL STIMULATION, PLOWSHARE, ETC.

5986 (LA-UR—77-2066) **Hybrid computers for simulation of gas diffusion in fractured shale.** Springer, T.E. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 11p. (CONF-771038—1). MF A01.

From Eastern gas shale program conference; Morgantown, West Virginia, USA (17 Oct 1977).

To stimulate gas recovery from Devonian shales, extraction technologies may include hydraulic, explosive, and natural fractures, chemical leaching, and gas displacement. A computational technique is described using a hybrid (analog and digital) computer whose ultimate objective will involve simulation of experiments based on proposed extraction technologies to establish optimum economic stimulation methods. The technique has the potential use of determining expected values of production when only statistical distributions of crack densities, permeabilities, and other geophysical properties are known.

5987 (SAND—77-1020C) **Results from a MHF surface electrical potential mapping experiment.** Schuster, C.L.; Keck, L.J. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 8p. (CONF-771038—2). Dep. NTIS, PC A02/MF A01.

From Eastern gas shale program conference; Morgantown, West Virginia, USA (17 Oct 1977).

Sandia Laboratories has developed a surface electrical potential system for remotely determining the azimuthal orientation of massive hydraulic fractures. The basis of the system is to use the fracture well as a current electrode which changes geometry as the conductive fluid is pumped out into the formation. This results in a changing electric potential field at the surface which is measured radially around the well. The system was deployed for a massive hydraulic fracturing (MHF) experiment with Columbia Gas in the Devonian Shale during August 1976 in Lincoln County, West Virginia. Several operational problems during the two days of fracturing somewhat impaired the data. Potential changes during the pumping did indicate fracture growth; however, the data did not give a clear indication as to its orientation. A screen-out that occurred at the end of the first day's pumping did produce some interesting potential changes.

5988 (UCRL—79021) **Microstructure of laboratory and nuclear explosively deformed gas-bearing sandstones.** Dengler, L.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1977. Contract W-7405-ENG-48. 31p. (CONF-770706—29). Dep. NTIS, PC A03/MF A01.

From 6. AIRAPT international high-pressure conference; Boulder, Colorado, United States of America (USA) (25 Jul 1977).

Pore structure and microfracturing is investigated in low permeability sandstones. An intricate network of clay minerals between grains causes the average pore size to be small in the undeformed rock. Laboratory loading causes sample compaction, short, unconnected cracks within grains, and frequent grain boundary cracks. Explosively deformed samples exhibit macroscopic fractures extending the length of the sample and occasional narrow transgranular cracks. In both, the clay matrix exhibits compaction parallel to the direction of maximum principal stress.

5989 **Method for increasing the recovery of natural gas from a geo-pressured aquifer.** Cook, H.L. Jr.; Geer, E.C. (to Transco Energy Co.). US Patent 4,042,034. 16 Aug 1977. Filed date 24 May 1976. 10p.

A method is claimed of increasing the recovery of natural gas from a geo-pressured aquifer containing water and gas and having a zone of free gas dispersed in water, by providing one or more wells extending from the surface to and completed in the geo-pressured aquifer in said zone and allowing the aquifer to flow water and gas under natural pressure through the well and lowering the pressure in the aquifer sufficiently to allow the gas to be released from solution in the water whereby the gas released will migrate more freely to the well and be produced. Also, my gas-phase saturation in the aquifer and any deposit of gaseous hydrocarbons in the formation in pressure communication with the wells will expand due to lowered aquifer pressure and be encouraged to flow to the wells and be recovered. Preferably, the wells are produced at a high enough rate of production to reduce the existing aquifer pressure in the drainage area of the wells as quickly as possible so that gas may be released from solution in the water and so that gaseous hydrocarbons in the formation may expand and flow to the wells. A high initial flow rate of at least 15,000 barrels of water per day from each well is necessary to effect the lowering of the aquifer pressure by at least 25% in order to provide the necessary mobility of the gas to obtain the enhanced gas recovery by the present method.

5990 **Method for increasing the recovery of natural gas from a geo-pressured aquifer.** Cook H.L. Jr.; Geer, E.C.; Katz, D.L. (to Transco Energy Co.). US Patent 4,040,487. 9 Aug 1977. Filed date 24 May 1976. 10p.

A method of increasing the recovery of natural gas from a geo-pressured aquifer containing water and gas and having a zone of free gas dispersed in water, by providing one or more wells extending from the surface to and completed in the geo-pressured aquifer in said zone and allowing the aquifer to flow water and gas under natural pressure through the well and lowering the pressure in the aquifer sufficiently to allow the gas to be released from solution in the water whereby the gas released will migrate more freely to the well and be produced. Also, any gas-phase saturation in the aquifer and any deposit of gaseous hydrocarbons in the formation in pressure communication with the wells will expand due to lowered aquifer pressure and be encouraged to flow to the wells and be recovered. Preferably, the wells are produced at a high enough rate of production to reduce the existing aquifer pressure in the drainage area of the wells as quickly as possible so that gas may be released from solution in the water and so that gaseous hydrocarbons in the formation may expand and flow to the wells. A high initial flow rate of at least 15,000 barrels of water per day from each well is necessary to effect the lowering of the aquifer pressure by at least 25% in order to provide the necessary mobility of the gas to obtain the enhanced gas recovery by the present method.

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 6854

5991 (NP—22448) **LP-Gas Transportation and Storage Subcommittee of LP-Gas Industry Advisory Committee on the study of future U.S. requirements for propane and butanes through 1980.** (Williams Companies, Tulsa, Okla. (USA)). 1977. vp. Companies, Tulsa, OK.

Demand for LP gas, propane and butanes, in U.S. is forecast to increase moderately through 1980, with demand volumes rising from 988,000 bbl/d in 1976 to 1,235,000 bbl/d in 1980. Consumption by residual and commercial users is forecast to increase from 440,000 bbl/d in 1976 to 486,000 bbl/d in 1980. The largest demand increases are expected to occur with industrial users and as petrochemical feedstocks, with industrial propane volumes increasing from 63,000 bbl/d in 1976 to 105,000 bbl/d and chemical propane volumes from 125,000 to 200,000 bbl/d. The largest LP gas consuming areas are the Midwest, Great Plains, South, and Southwest. Total supplies from U.S. sources are expected to decline; LP gas refinery production should increase, but not enough to offset expected decreases from gas plant production. Imports from Canada should remain the same. Overseas imports would fill the shortfall and provide the products to serve the demand increases. Although new overseas production projects are expected to provide adequate supply to U.S. and other world markets, delays are expected for some of them. Vessels and import terminals are projected to be adequate to handle the increased imports. Expansions will be needed in primary storage facilities for East Coast terminals, and for shipments from terminals to markets. (DLC)

TRANSPORT, PIPELINES, AND HANDLING

REFER ALSO TO CITATION(S) 5978, 6961

OIL SHALES AND TAR SANDS

RESERVES AND EXPLORATION

REFER ALSO TO CITATION(S) 6886

5992 **Upper Cretaceous Frontier Formation in the Kaycee-Tisdale Mountain area, Johnson County, Wyoming.** Merewether, E.A.; Cobban, W.A.; Spencer, C.W. (Geological Survey, Lakewood, CO). pp 33-44 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

The sandstone at the top of the Frontier is named the Wall Creek Sandstone Member and is as much as 70 ft thick. In this area, the formation was deposited in an epicontinental sea during early Late Cretaceous time and contains marine fossils of Cenomanian and Turonian age. The stratigraphy of the Frontier and the lower part of the Cody on the western flank of the Powder River Basin is described, and data from outcrops are related to well logs of these strata. This report includes a preliminary description of outcrops near Tisdale Mountain and the town of Kaycee, as well as core from a hole at Bailey Flats in NE¼ SW¼ Sec. 6, T.42N., R.81W.

5993 (FE—2346-14) **Energy from in situ processing of Antrim shale. Monthly technical progress report for August 1977.** Humphrey, J.P. (Dow Chemical Co., Midland, Mich. (USA). Hydrocarbons and Energy Research Dept.). 16 Sep 1977. Contract EX-76-C-01-2346. 39p. Dep. NTIS, PC A03/MF A01.

Activities are reported in a program to test the technical feasibility for the in situ processing of Antrim Shale to produce energy values. In general research more core chips were collected for the resource evaluation stratigraphic study and environmental monitoring was initiated. In Dow/Rhoburn Well Project permeability measurements by tracer gas injection were completed to yield quantitative measures of permeability and porosity of the Antrim Shale in the vicinity of each well. The downhole ignition experiment was started. Electrical short circuits in the ignition system forced discontinuance of the heater trials. Data were collected and auxiliary gas monitoring procedures were tested. In Dow/ERDA Well Project initial gas analyses from the core degassing experiment were obtained and evaluated. The notching and fracturing experiment was started. Notching with the Dowell Abrasijet was successful; however, vertical fractures induced in the shale made necessary a re-evaluation of hydrofracing techniques and objectives. A "wide-angle" two foot notched underreaming was accomplished using the Dowell Abrasijet service (a perforating service). Massive amounts of geochemical and geophysical data have been obtained by subcontractors for examination of the core from Well No. 100. Difficulty is still being experienced in preparation of samples for strength tests due to the weakness across bedding planes of some of the shale. A review of the literature on oil shale decomposition kinetics has been completed and preliminary testing with a thermogravimetric analysis system has begun.

SITE GEOLOGY AND HYDROLOGY

SITE GEOLOGY

REFER ALSO TO CITATION(S) 5830, 5913

5994 (CONF-7609125—, pp 17p, Paper 15) **Paleolimnology and oil shale genesis in Green River Formation, Colorado.** Lee, K.K. (Univ. of Wisconsin, Milwaukee); Smith, J.W. 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The Green River Formation was formed from sediments laid down in a series of ancient lake beds of Middle Eocene age in Colorado, Utah and Wyoming, USA. The formation contains hydrogen-rich organic matter in its oil shales which represent 2 trillion barrels of shale oil in place and it covers an area of 17,000 square miles (44,030 km²). The continuous oil shale was formed under a combination of physical, biological and chemical conditions in a stratified lake. The initial study is aimed to provide evidence in postulating the physical conditions in which appropriate geochemical and sedimentation process could form oil shale. One of the major needs in generating further understanding of the Eocene Green River Formation would be in the investigation of their physical paleolimnology. The lake dynamics provides a critical mechanism for heat transfer, mixing, turbulence and particle settling. It also affects the productivity of organic material, concentration and decomposition of organic material and ultimately the reaction rate and balance of geochemical processes. The study approach can be a powerful tool to interpret the unique oil shale formation and its distribution.

SITE HYDROLOGY

5995 (CONF-7609125—, pp 16p, Paper 23) **Geochemistry of oil-shale aquifers, Piceance Basin, northwestern Colorado.** Saulnier, G.J. (Geological Survey, Denver). 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The Piceance basin of northwestern Colorado is currently the principal proposed oil-shale mining area of the United States. The kerogenaceous marlstones of the Green River Formation contain large quantities of the evaporative bicarbonate, nahcolite. Deformation of the oil shale has resulted in fracture permeability allowing the dissolution of the nahcolite and associated minerals. The dissolution and distribution of sodium, bicarbonate, and important trace constituents in ground water are controlled by a basin-flow system that has been modeled as a two-aquifer system separated by a confining layer which is the zone of principal mining interest for initial development. Dissolved-solids concentrations in the deeper aquifer range from less than 1,000 milligrams per litre to greater than 30,000 milligrams per litre. Field pH values range from 7.5 to 8.8 and the presence of gaseous hydrogen sulfide suggests a reducing environment in the organic-rich oil shales. Concentrations of certain trace constituents, primarily fluoride, are much higher than median ground-water concentrations in North America. The highest measured dissolved-fluoride concentration is 95 milligrams per litre. The mineral residence of fluoride is in authigenic fluorite, cryolite, fluorapatite, and neighborite ($NaMgF_3$). Lithium, barium, boron, and strontium also contain greater than median concentrations for North America. A solution to the lateral dispersion equation is being used to model the vertical distribution of dissolved solids within the deeper aquifer. The proposed underground and strip mining of oil shale in the Piceance basin will undoubtedly alter the ground-water flow system and this change could result in increased salt dissolution with subsequent discharge problems associated with mine dewatering.

DRILLING, FRACTURING, AND MINING

REFER ALSO TO CITATION(S) 5986

OIL PRODUCTION, RECOVERY, AND REFINING

REFER ALSO TO CITATION(S) 5966

5996 (NP—22413) **Statement to the Committee on Energy and Natural Resources, Subcommittee on Energy Research and Water Resources, United States Senate.** Brown, C.H. (Tosco Corp., Los Angeles, Calif. (USA)). 11 Mar 1977. vp. Corp., Los Angeles, CA.

It is stated that, with no government assistance, commercial oil shale development will wither. The Senate bill S. 419, sponsored by Sen. Haskell, is highly recommended. It is suggested that the best oil shale tract be selected, and that several promising technologies be tested on one tract. Appendices discuss the Colony project, shale oil economics, environment, the advantages of demonstrating several technologies, suggested changes to S. 419, and risk reduction. (DLC)

IN SITU METHODS, TRUE AND MODIFIED

5997 **Thermal recovery of hydrocarbons from tar sands.** Cram, P.J.; Redford, D.A. (to Texaco Exploration Canada Ltd.). US Patent 4,046,195. 6 Sep 1977. Filed date 18 Jun 1975. 6p.

A method for the recovery of low API gravity viscous oils or bitumen from a subterranean formation by the injection of steam followed by a mixture of an oxygen-containing gas and steam until an optimum amount of gas has been injected, followed by injection of steam alone.

5998 **In situ recovery of shale oil.** French, G.B. (to Occidental Oil Shale, Inc.). US Patent 4,043,595. 23 Aug 1977. Filed date 11 Aug 1975. 48p.

An in situ oil shale retort is formed in a subterranean oil shale deposit by excavating a columnar void having a vertically extending free face, drilling blasting holes adjacent to the columnar void and parallel to the free face, loading the blasting holes with explosive, and detonating the explosive in a single round to expand the shale

adjacent to the columnar void toward the free face in layers severed in a sequence progressing away from the free face and to fill with fragmented oil shale the columnar void and the space in the in situ retort originally occupied by the expanded shale prior to the expansion. A room having a horizontal floor plan that coincides approximately with the horizontal cross section of the retort to be formed is excavated so as to intersect the columnar void. The blasting holes are drilled and loaded with explosive from the room. The room can lie above the columnar void, below the columnar void, or intermediate the ends of the columnar void. In one embodiment, the columnar void is cylindrical and the blasting holes are arranged in concentric rings around the columnar void. In another embodiment, the columnar void is a slot having one or more large parallel, planar vertical free faces, toward which the oil shale in the retort under construction can be explosively expanded. The blasting holes are arranged in planes parallel to these faces. The resulting retort generally has a cross section coinciding with the placement of the blasting holes and a height determined for the greater part by the vertical height of the columnar void. To form a retort having a large cross-sectional area, a plurality of columnar voids can be excavated and the shale in the retort expanded toward the respective columnar voids to form a continuous fragmented permeable mass of oil shale.

5999 Multiple level preparation of oil shale retort. French, G.B. (to Occidental Oil Shale, Inc.). US Patent 4,043,597. 23 Aug 1977. Filed date 17 Feb 1976. 16p.

A subterranean deposit containing oil shale is prepared for in situ retorting by initially excavating a plurality of vertically spaced apart voids of similar horizontal cross section located one above another within the deposit. A zone of unfragmented deposit temporarily left between each adjacent pair of voids has a thickness greater than the smallest lateral dimension of the voids above and below it. Explosive placed in a lower portion of the unfragmented zone is detonated to expand the lower portion of the unfragmented zone into the lower void, leaving the upper portion of the zone intact and creating a space free of fragmented particles below it. Thereafter, the remaining portion of the unfragmented zone is explosively expanded into the open space below it and into the upper void, forming a subterranean room filled with a fragmented mass of particles having a void volume substantially equal to the total initial volume of the voids. Retorting of the expanded mass is then carried out to discover shale oil from the oil shale.

6000 Forming shale oil recovery retort by blasting into slot-shaped columner void. Ridley, R.D. (to Occidental Oil Shale, Inc.). US Patent 4,043,596. 23 Aug 1977. Filed date 11 Aug 1975. 18p.

An in situ oil shale retort is formed in a subterranean oil shale deposit by excavating one or more slot-shaped columnar voids each having a pair of vertically extending, planar free faces, drilling blasting holes adjacent to the columnar void and parallel to the free faces, loading the blasting holes with explosive, and detonating the explosive in a single round to expand the shale adjacent to the columnar void one directionally toward each free face in one or more planar layers severed in a sequence progressing away from each free face and to fill with fragmented oil shale the columnar void and the space in the in situ retort originally occupied by the expanded shale prior to the expansion. The pair of free faces extend across the entire width (or length) of the retort being formed. A room having a horizontal floor plan that coincides approximately with the horizontal cross section of the retort to be formed is excavated so as to intersect the columnar void. The blasting holes are drilled and loaded with explosive from the room.

6001 Multiple zone preparation of oil shale retort. French, G.B.; Garrett, D.E. (to Occidental Oil Shale, Inc.). US Patent 4,043,598. 23 Aug 1977. Filed date 20 Feb 1976. 18p.

A subterranean deposit containing oil shale is prepared for in situ retorting by initially excavating a plurality of vertically spaced apart voids of similar horizontal cross section located one above another within the deposit. A plurality of vertically spaced apart zones of unfragmented deposit are temporarily left between the voids, each unfragmented zone having a thickness of less than about 190 percent of the smallest lateral dimension of the voids above and below it. Explosive placed in each of the unfragmented zones is detonated, preferably in a single round to expand each unfragmented zone into the voids on either side of it and form a subterranean room containing a fragmented mass of particles having a void volume equal to the void volume of the initial voids. Retorting of the expanded mass is then carried out to recover shale oil from the oil shale.

6002 Recovery of petroleum from viscous asphaltic petroleum containing formations including tar sand deposits. Allen, J.C.; Woodward, C.D. (to Texaco Inc.). US Patent 4,042,027. 16 Aug 1977. Filed date 24 Jun 1974. 10p.

Petroleum materials may be effectively recovered from subterranean, viscous, asphaltic or bituminous formations such as tar sand deposits by first injecting into the tar sand formation a paraffinic hydrocarbon at a temperature below 300°F which precipitates asphaltic material from the asphaltic petroleum in the formation. Next, solvent injection is terminated and air is injected into the formation, and the formation is ignited to accomplish in situ combustion within the tar sand reservoir utilizing the precipitated asphaltic materials for fuel for the in situ combustion reaction. Reaction temperatures higher than normal in situ combustion temperatures are produced, facilitating thermal cracking and in situ hydrogenation to up grade the produced crude within the tar sand reservoir.

6003 Enriching off gas from oil shale retort. Cha, C.Y.; Ridley, R.D. (to Occidental Oil Shale, Inc.). US Patent 4,036,299. 19 Jul 1977. Filed date 22 Sep 1975. 20p.

Liquid and gaseous products are recovered from oil shale in an in situ oil shale retort in which a combustion zone is advanced therethrough by a method which includes the steps of establishing a combustion zone in the oil shale in the in situ oil shale retort and introducing a gaseous feed mixture into the combustion zone in the direction the combustion zone is to be advanced through the in situ oil shale retort. The gaseous feed mixture comprises an oxygen supplying gas and water vapor and is introduced into the combustion zone at a rate sufficient to maintain the temperature in the combustion zone within a predetermined range of temperatures above the retorting temperature of the oil shale in the in situ oil shale retort and sufficient to advance the combustion zone through the in situ oil shale retort. The introduction of the gaseous feed mixture into the combustion zone generates combustion products gases which together with the portion of the gaseous feed mixture which does not take part in the combustion process, is called flue gas. The flue gas passes through the oil shale on the advancing side of the combustion zone, thereby retorting the oil shale to produce liquid and gaseous products. The liquid product and the retort off gas, which comprises gaseous product and flue gas, are withdrawn from the in situ oil shale retort at a point on the advancing side of the retorting zone. 47 claims, 1 figure.

6004 (SAND—77-6014) **Study of the production of shale oil from oil shale in Wurtemberg.** Reed, F.H. (Sandia Labs., Albuquerque, N.Mex. (USA)). May 1977. Translation by P. Newman of FIAT final report No. 447. 93p. Dep. NTIS, PC A05/MF A01.

In Appendix A the geology of the Wurtemburg oil shale deposits is described and development of oil shale processing plants during World War II in that area is reviewed. It is noted that of ten planned plants four were producing at the time of Allied Occupation. In Appendix B, experimental underground distillation of oil shale near Schorzingen is described. Test results showed that it is possible to distill Pasidonia oil shale underground. In Appendix C, underground distillation experiments are described in which the effects of distillation chamber cross section were evaluated. In Appendix D, experiments conducted to evaluate underground oil shale distillation in very large chambers are described. Operational data are included with each appendix. (JRD)

SURFACE METHODS

6005 Solvent extraction of oil from tar sands utilizing a trichloroethylene solvent. Blaine, N.F.; Blaine, G. US Patent 4,046,669. 6 Sep 1977. Filed date 19 Jan 1976. 4p.

Oil is efficiently solvent extracted from tar sands utilizing a trichloroethylene solvent at mild conditions. The process preferably utilizes minor amounts of surfactant and polyelectrolytes. The process has resulted in unexpectedly high yields of oil with unexpectedly low solvent loss.

6006 Double solvent extraction of organic constituents from tar sands. Farcasiu, M.; Whitehurst, D.D. (to Mobil Oil Corp.). US Patent 4,046,668. 6 Sep 1977. Filed date 12 Jan 1976. 6p.

Extraction of hydrocarbons from tar sands with a light naphtha/methanol solvent system results in rapid decrepitation of the tar-sand aggregate and separation of organic matter into three phases. Distribution of the extracted and non-extracted organic material is among the phases. The most desirable, non-polar organic materials are recovered from the light naphtha phase; more polar soluble constituents are recovered from the methanol phase; and less desirable asphaltenes separate as a precipitate.

REFINING

REFER ALSO TO CITATION(S) 6114

PROPERTIES AND COMPOSITION

REFER ALSO TO CITATION(S) 6111

6007 (LERC/RI—77/6) **Thermal analysis on oil shale: determination of potential oil yields and dawsonite, nahcolite, and nordstrandite content.** Johnson, D.R.; Young, N.B.; Smith, J.W. (Energy Research and Development Administration, Laramie, Wyo. (USA).

Laramie Energy Research Center). 1977. 20p. Dep. NTIS, PC A02/MF A01.

Thermal analysis was applied to Green River Formation oil shales to demonstrate the method's capabilities for estimating oil yields and for determining dawsonite, nahcolite and nordstrandite. A single sample heated in thermal analysis apparatus incorporating differential thermal analysis (DTA) and thermogravimetry (TG) will produce quantitative data on the three oil shale minerals and excellent oil yield estimates. Coefficients of determination (R^2) ranged from 0.88 for dawsonite and nordstrandite determinations to 0.998 for nahcolite. Requirements to be met by thermal analysis equipment to obtain accurate oil-shale compositional data are outlined. The method is especially useful where minerals are encountered that interfere with other analyticl techniques.

DIRECT USES AND BY-PRODUCTS

REFER ALSO TO CITATION(S) 5970

FISSION FUELS

REFER ALSO TO CITATION(S) 5889, 6897

RESERVES

REFER ALSO TO CITATION(S) 6886

6008 (USGS-OFR—76-454) **Fluid flow and ionic diffusion and their roles in the genesis of sandstone-type uranium ore bodies.** Granger, H.C. (Geological Survey, Reston, Va. (USA)). 1976. 26p. TIC.

Mechanisms of U ore forming processes are discussed. These ores are deposited in response to three principal mechanisms including concentration to a point of saturation through solvent loss, precipitation caused by reactions between solutions, and precipitation caused by reactions between solutions and the host rock. These mechanisms can be augmented by the scavenging effects of certain organic materials by adsorption, reduction, or chelation. (JRD)

6009 (USGS-OFR—77-218) **Uranium and thorium resource assessment and exploration research program, fiscal year 1977.** Finch, W.I. (Geological Survey, Reston, Va. (USA)). 1977. 29p. TIC.

Since the US ERDA has a NURE program, the US GS will limit itself to making local and regional uranium resource assessments. The program includes seven elements: theory of origin, geophysical techniques, geochemical techniques, basin analysis, mining district studies, frontier studies, and resource assessment. Each element is discussed individually. (DLC)

6010 **Relationships between early Tertiary sedimentation patterns and uranium mineralization in the Powder River Basin, Wyoming.** Seeland, D.A. (Geological Survey, Denver). pp 53-64 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Paleocurrent maps that show transport directions and textural studies in the Eocene fluvial sandstones of the Powder River Basin define sedimentation patterns and source areas that appear to account for the localization of the uranium deposits of the basin. The uranium districts of the early Tertiary are all in the southern part of the basin. More than 80 percent of the area of the districts and all of the higher grade, larger deposits lie in the parts of these districts where the arkosic-sandstone host rock is derived primarily from the Precambrian core of the Laramie Range. The Hartville uplift provided a small part of the sediment in the southern Powder River Basin; but, more importantly, it prevented the streams of the northwest flank of the Laramie Range from flowing eastward onto the Great Plains as they do today. The strong correlation between a specific granitic source terrane and uranium deposits favors arkose rather than uraniferous tuff as the primary source of the uranium that formed the Wyoming sandstone deposits. Suggested exploration target areas in the Powder River Basin include: (1) the less explored parts of the area that contains rocks with a Laramie Mountains provenance, (2) the channel sandstones of the Eocene Wind River, and (3) the channel sandstones of the major paleo-drainage that marks the boundary between Wasatch Formation with a Black Hills source and Wasatch Formation with a Laramie Mountains source.

6011 **Evaluation of uranium resources in the Powder River Basin, Wyoming.** Curry, D.L. (Energy Research and Development Administration, Grand Junction, CO). pp 235-242 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

For convenience in estimating and reporting uranium resources, the U.S. Energy Research and Development Administration (ERDA) has divided the country into 13 resource regions, chiefly on the basis of geologic considerations. The Powder River Basin is in the Wyoming Basins resource region, which includes all of the intermontane basins in Wyoming and the Sand Wash Basin in northwestern Colorado. Other basins in this region are the Green River, Washakie, Great Divide, Wind River, Laramie, Hanna, Shirley, and Big Horn. Included with the basins, because of their relatively low relief, are the Rock Springs, Sweetwater, Rawlins, and Hartville uplifts. Wyoming uranium deposits have become almost synonymous with the term "roll," as this type of deposit predominates in the state. The deposits result from the gradual encroachment of uraniferous oxidizing solutions generally downdip into unoxidized permeable sandstone. The uranium deposits are generally considered to be gradually enriched as they migrate with an oxidation-reduction, or solution, front, from the addition of exogenic uranium and/or the solution and redeposition of syngenetic uranium. The principal sources of uranium are considered to be: (1) Precambrian granitic rocks, chiefly from the Granite and Laramie Mountains; and (2) uraniferous tuffs, which were important constituents of Oligocene to Pliocene sedimentary rocks that once blanketed the region.

6012 **Genesis and characteristics of the southern Powder River Basin uranium deposits, Wyoming.** Dahl, A.R. (Exxon Co., Denver); Hagmaier, J.L. pp 243-252 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

Uranium deposits in the southern Powder River Basin of Wyoming are excellent examples of large roll-type ore bodies. The host rocks are Paleocene sandstones deposited as point bars by a meandering stream. The source of uranium is tuffaceous and arkosic debris indigenous to the sedimentary sequence containing the host rocks. The largest deposits of highest grade occur near the distal margins of permeable, slightly dipping sandstones where they grade laterally into organic-rich siltstones, claystones and lignites deposited in backswamp or flood basin environments. The deposits are epigenetic in origin, formed by precipitation of uranium from groundwater solutions that moved through the host rocks from a recharge area southwest of the deposits towards a discharge area northeast of the deposits. The deposits are large because the host rocks are extensive and the groundwater system remained relatively stable. Pyrite formed early in and around the host units through a biogenic process utilizing sulfate-reducing bacteria. This was important in establishing a permissive geo-chemical environment for later ore genesis. Oxidation of pyrite by incursing groundwater caused sulfite to form. Sulfite disproportionation into SO_4^{2-} and HS^- developed the final reducing mechanism for uranium precipitation in the ore rolls. Deposit characteristics and associated alteration products are compatible with the chemical theory of Granger and Warren.

EXPLORATION

REFER ALSO TO CITATION(S) 7613

6013 (GJBX—64(77)) **Uranium favorability of tertiary sedimentary rocks in the northern Green River Basin and Hoback Basin, Wyoming.** Lease, L.W.; D'Andrea, F. Jr.; Hesse, S.L.; Rood, R.E. (Bendix Field Engineering Corp., Grand Junction, Colo. (USA)). Oct 1977. Contract EY-76-C-13-1664. 96p. Dep. NTIS, PC A05/MF A01.

This project was undertaken to evaluate the favorability for uranium of Tertiary sedimentary rocks in the northern Green River Basin and in the Hoback Basin in western Wyoming. Surface and subsurface investigations were conducted, and areas of favorable lithology for uranium host rocks were delineated. The only known uranium deposits within the project boundaries are in the vicinity of the Pard mine. Only one of the assayed surface samples outside the area of the Pard mine contained an anomalous quantity of uranium (38 ppM). No obvious alteration, other than surface weathering, was recognized at any of the outcrops examined or sampled. On the basis of drill-hole data, the distribution of pyrite in the subsurface indicates a reducing environment over most of the project area. Organic carbon is not common in outcrops or in the subsurface. Gamma-ray spectrometer analyses of the probable granitic source of arkosic

conglomerates and sandstones in the Green River Basin suggest that both the granites and the arkosic sediments derived from them should be considered as possible sources of uranium in the northern Green River Basin. The analyses have shown that the uranium content of these granites is within the range of uranium contents of granitic rocks of the Granite and Seminoe Mountains, which are possible sources of uranium for the Gas Hills, Crooks Gap, and Shirley Basin uranium deposits. The present low uranium values in samples of the tuffaceous middle Eocene Bridger Formation suggest a low favorability of the Bridger as a source of uranium. An area of boulder conglomerates extending northward from the Pard mine along the flanks of Prospect Mountain and Little Prospect Mountain is considered favorable because of its similarity to the Pard mind lithology.

6014 (GJBX—68(77)) **Preliminary study of the uranium potential of the Triassic—Jurassic Basin in Connecticut and Massachusetts.** Truesdell, D.B.; Zollinger, R.C. (Bendix Field Engineering Corp., Grand Junction, Colo. (USA)). Oct 1977. Contract EY-C-13-1664. 29p. Dep. NTIS, PC A03/MF A01.

The uranium favorability of the Connecticut Basin was studied to determine if more detailed geologic investigation in the area is warranted. Preliminary reconnaissance shows that the basin is favorable for uranium. Further study of the area will be necessary to define the uranium potential. Each sedimentary formation within the basin was studied and sampled as a possible uranium host rock. Samples were also taken from several prospective source rocks within the basin and the adjacent highlands. Analytical results and a ground radiometric survey indicate no anomalous radioactivity in the surface except in the Newgate Prison mine area. However, the sedimentary units in the basin can be good hosts for uranium and potential uranium source rocks are abundant.

6015 (GJBX—73(77)) **Studies on airborne optical detection of uranium ore.** Lampley, C.M.; Wells, M.B. (Radiation Research Associates, Inc., Fort Worth, Tex. (USA)). 1977. 59p. Dep. NTIS, PC A04/MF A01.

The results of calculations performed to determine the feasibility of locating uranium resources through the use of airborne optical detection systems measuring the air-fluorescent signal produced by gamma-ray energy deposition in the lower atmosphere above ore deposits are described. This energy was computed using the one-dimensional, anisotropic scattering, discrete ordinates radiation transport code ANISN. Included is a description of the hypothetical uranium ore body upon which these calculations are based. The unscattered air-fluorescent signal reaching an airborne detector was computed for seven wavelengths between 0.3 and 0.9 microns. The effect of airborne radionuclides upon the air-fluorescent light signal produced is examined and the results are compared to background levels generated by sunlight, moonlight, and nightglow. The results of a survey of current state-of-the-art photodetectors are presented in an attempt to determine the optimum detectability of the low light levels generated by the ore body. The conclusion of this study is that the level of naturally-occurring background radiation precludes any serious considerations as to the implementation of such a detection scheme.

6016 (GJO—1659-1) **Geochemical dispersion of uranium near prospects in Pennsylvania.** Rose, A.W.; Schmiermund, R.L.; Mahar, D.L. (Pennsylvania State Univ., University Park (USA)). Jun 1977. Contract EY-76-C-13-1659. 100p. (GJBX—58(77)). Dep. NTIS, PC A05/MF A01.

The geochemical dispersion of U was investigated near sedimentary uranium prospects in eastern and north-central Pennsylvania. Near Jim Thorpe, known uranium occurrences in the Catskill Fm. are limited to the base of the Duncannon member. At Penn Haven Junction, roll-type U deposits with appreciable Pb and Se are localized adjacent to an oxidized tongue of channel-filling conglomeratic sandstone. The channel and encircling U occurrences furnish a large target for geochemical exploration. Selective extractions show that the organic, Fe-oxide, sand and silt fractions of stream sediments are the major hosts for U in stream sediments. Fe-oxides have a greater affinity for U than organic matter but are less abundant. The U content of organic matter is about 10^5 times the U content of stream water. Stream sediments furnish a representative sample of the average content of U, Zn, Cu, and major elements in soils of a drainage basin in north-central Pennsylvania, so a semiquantitative appraisal of weathering uranium occurrences can be made from stream sediments in climates and topography like Pennsylvania. The flux of uranium leaving the basin in solution is about equal to that leaving as sediment. Uranium is considerably less mobile than Ca and Na. A new method of extracting uranium from water samples, using a liquid ion exchanger (Amberlite LA-1), shows promise for simple field application. (18 figs., 12 tables)

6017 (RMO—830(Rev.)) **Drilling in the Monument Valley Area of Arizona and Utah.** Chester, J.W.; Donnerstag, P.H. (Energy Research and Development Administration, Grand Junction, Colo. (USA). Grand Junction Office). 4 Jun 1952. 67p. Dep. NTIS, PC A04/MF A01.

Drilling in the Monument Valley area totaled 50,353.1 feet and was carried out under three contracts. Two main areas were drilled; one in the vicinity of Monument No. 2 mine in Apache County, Arizona; and the other on Oljetoh Mesa in San Juan County, Utah. Contract AT(30-1)-1258 began February 1, 1952, and ended April 25, 1952; contract AT(05-1)-120 began July 17, 1951, and ended August 7, 1951; and contract AT(30-1)-1142 began August 1, 1951, and ended November 27, 1951. The largest mine in the region is the Monument No. 2 mine owned by the Vanadium Corporation of America. Several other small mines are operating or have operated in the vicinity. Information pertinent to drill operations and the uranium deposits were obtained.

MINING

6018 **Bear Creek uranium project.** Buturla, F.J.; Schwenk, M.E. (Rocky Mountain Energy Co., Casper, WY). pp 231-234 of In Geology and energy resources of the Powder River. Laudon, R.B.; Curry, W.H. III; Runge, J.S. (eds.). Casper, WY; Wyoming Geological Association (1976).

From 28. annual field conference of the Wyoming Geological Association; Casper, Wyoming, USA (Sep 1976).

See CONF-7609159—.

The Bear Creek deposit is a typical epigenetic roll front deposit. It was formed as a result of a geochemical front that precipitated the minerals along a facies change from coarse to fine clastic sediments. Uraninite is the major ore mineral present. A small amount of coffinite and traces of carnotite have been found. The Bear Creek Project represents one of the first new uranium operations resulting from the rapidly rising prices of uranium. Over 8 years of exploration drilling and engineering design have been invested in the project which, because of its low grade nature, required the higher price presently found in the market to become a mine. The first ore from the Bear Creek Project may be the first of many efforts to bring resources into reserves; however, while no one can accurately predict market or government action, let's all hope it's not the last.

FEED PROCESSING

REFER ALSO TO CITATION(S) 7185

ENRICHMENT

6019 (K/TD—362) **Uranium enrichment: a review of the present world status: capacity, technology, and plans.** Wilcox, W.J. Jr. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 1977. Contract W-7405-ENG-26. 59p. (CONF-770572—1; CONF-770574—1). Dep. NTIS, PC A04/MF A01.

From Eastern Carolinas Section of the American Nuclear Society meeting; Wilmington, North Carolina, United States of America (USA) (6 May 1977).

This paper presents a general overview of the states of the various enrichment technologies (gaseous diffusion, centrifuge, aerodynamic, laser, plasma), a review of the activities in various countries, and a discussion of the supply and demand market for enrichment. 43 figures. (DLC)

GASEOUS DIFFUSION

6020 (K—1899) **Calculator program for the comparison of particle size distribution measurements between transmission electron microscopy and the liquid centrifuge technique.** Postma, F.W. Jr. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 31p. Dep. NTIS, PC A03/MF A01.

Conversion of large quantities of data from units obtained by one analytical method to the units of a second analytical method, and subsequent comparison of the results of the two analytical methods by use of graphs and their equations, has been accomplished using a programmable desk top calculator and plotter. The method has several advantages over hand operations and has proven effective in the comparison of two particle size distribution methods.

LASER EXCITATION

6021 (LA-UR—76-191) **Some developments in laser isotope separation research at Los Alamos.** Robinson, C.P.; Jensen, R.J. (Los Alamos Scientific Lab., N.Mex. (USA)). Feb 1975. Contract W-7405-ENG-36. 28p. Dep. NTIS, PC A03/MF A01.

The supersonic expansion of bulk gas samples to obtain low vibrational and rotational temperatures that allow detailed resolution

of the infrared absorption features of isotopic molecules ($^{235}UF_6$ and $^{238}UF_6$) is discussed. (LK)

6022 (UCRL—13744-2) **Cost analysis of lasers for a laser isotope separation system. Final report.** Mail, R.A.; Markovich, F.J.; Carr, R.H. (General Research Corp., Santa Barbara, Calif. (USA)). Jan 1977. Contract W-7405-ENG-48-2411303. 85p. Dep. NTIS, PC A05/MF A01.

To be of practical significance, laser isotope separation (LIS) for separation of ^{235}U from ^{238}U must exhibit attributes which make it preferable to expansion of the present facilities. Clearly the most attractive such attribute is the prospect of significant cost reductions, which preliminary studies at LLL suggest will amount to a factor of three and perhaps as much as ten. From these preliminary studies, it appears that the lasers themselves account for a very substantial portion of the capital cost of a LIS system, and a significant portion of the equipment replacement costs. Since the laser costs are so pivotal to the system cost, and the system cost is so pivotal to the choice of separation techniques, it is clear that a more detailed investigation of laser costs is required. Results are presented of a study performed by General Research Corporation (GRC) to assess the cost of lasers in a production laser isotope separation (LIS) plant. (JRD)

FUELS PRODUCTION AND PROPERTIES

REFER ALSO TO CITATION(S) 6049, 6611, 6618

6023 (ANL—77-66) **Statistical study of EBR-II fuel elements manufactured by the cold line at Argonne-West and by Atomics International.** Harkness, A.L. (Argonne National Lab., Ill. (USA)). Sep 1977. Contract W-31-109-ENG-38. 24p. Dep. NTIS, PC A02/MF A01.

Nine elements from each batch of fuel elements manufactured for the EBR-II reactor have been analyzed for ^{235}U content by NDA methods. These values, together with those of the manufacturer, are used to estimate the product variance and the variances of the two measuring methods. These variances are compared with the variances computed from the stipulations of the contract. A method is derived for resolving the several variances into their within-batch and between-batch components. Some of these variance components have also been estimated by independent and more familiar conventional methods for comparison.

6024 (ERDA—1550) **High Performance Fuel Laboratory, Hanford Reservation, Richland, Washington. Final environmental impact statement.** (Energy Research and Development Administration, Washington, D.C. (USA)). Sep 1977. 551p. NTIS, E08/MF E08.

The High Performance Fuel Laboratory (HPFL) will provide pilot scale tests of manufacturing processes, equipment, and handling systems and of accountability and safeguards, methods, and equipment while keeping radiological and chemical exposures of the workers, public, and environment at the lowest practicable levels. The experience gained from designing, constructing and operating the HPFL can be used in future commitments to commercial fuel fabrication plants in the late 1980s and beyond for processing of nuclear fuel. The HPFL site is located in the 400 Area of the 559-square mile, federally owned Hanford Reservation. This environmental impact statement considers effects of the HPFL under normal conditions and in the event of an accident.

6025 (ORNL—5300) **Resin-based preparation of HTGR fuels: operation of an engineering-scale uranium loading system.** Haas, P.A. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 86p. Dep. NTIS, PC A05/MF A01.

The fuel particles for recycle of ^{233}U to High-Temperature Gas-Cooled Reactors are prepared from uranium-loaded carboxylic acid ion exchange resins which are subsequently carbonized, converted, and refabricated. The development and operation of individual items of equipment and of an integrated system are described for the resin-loading part of the process. This engineering-scale system was full scale with respect to a hot demonstration facility, but was operated with natural uranium. The feed uranium, which consisted of uranyl nitrate solution containing excess nitric acid, was loaded by exchange with resin in the hydrogen form. In order to obtain high loadings, the uranyl nitrate must be acid deficient; therefore, nitric acid was extracted by a liquid organic amine which was regenerated to discharge a $NaNO_3$ or NH_4NO_3 solution waste. Water was removed from the uranyl nitrate solution by an evaporator that yielded condensate containing less than 0.5 ppM of uranium. The uranium-loaded resin was washed with condensate and dried to a controlled water content via microwave heating. The loading process was controlled via in-line measurements of the pH and density of the uranyl nitrate. The demonstrated capacity was 1 kg of uranium per hour for either batch loading contractors or a continuous column as the resin loading contractor. Fifty-four batch loading runs were made without a single failure of the process outlined in the chemical flowsheet or any evidence of inability to control the conditions dictated by the flowsheet.

6026 (ORNL/TM—6067) **HTGR fuel development: investigations of breakages of uranium-loaded weak acid resin microspheres.** Carpenter, J.A. Jr. (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 42p. Dep. NTIS, PC A03/MF A01.

During the HTGR fuel development program, a high percentage of uranium-loaded weak acid resin microspheres broke during pneumatic transfer, carbonization, and conversion. One batch had been loaded by the UO_3 method; the other by the ammonia neutralization method. To determine the causes of failure, samples of the two failed batches were investigated by optical microscopy, scanning electron microscopy, electron beam microprobe, and other techniques. Causes of failure are postulated and methods are suggested to prevent recurrence of this kind of failure.

6027 (WAPD-TM—1311) **Grain growth in thoria and thoria-base fuel pellets (LWBR development program).** Smid, R.J. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Jan 1976. Contract EY-76-C-11-0014. 249p. Dep. NTIS, PC A11/MF A01.

The kinetics of grain growth in ThO_2-base sintered compacts were investigated to determine the cause of a nonuniform microstructural cross section. It was concluded that trace impurities which inhibit continuous grain growth at the pellet interior were removed by vaporization at the pellet exterior. This resulted in relatively normal grain growth at the pellet surface and discontinuous grain growth at the pellet interior. Calcining the starting ThO_2 powder to a slightly higher temperature removed inhibiting impurities but also decreased the driving force for grain growth by reducing the surface area of the powder. Mixing high and low temperature calcined ThO_2 resulted in improved grain growth. Increased oxygen partial pressure and temperature during sintering increased grain boundary mobility in spite of the inhibiting impurity. The specific inhibiting impurity was not isolated during this investigation.

SPENT FUELS REPROCESSING

REFER ALSO TO CITATION(S) 6025, 6051, 6058, 6085, 6618, 7140

6028 (GA-A—14441) **Thorium utilization program. Quarterly progress report for the period ending May 31, 1977.** (General Atomic Co., San Diego, Calif. (USA)). Jun 1977. Contract EY-76-C-03-0167-053. 310p. Dep. NTIS, PC A14/MF A01.

Results of work performed under the National HTGR Fuel Recycle Program (also known as the Thorium Utilization Program) at General Atomic Company are presented. Results of work on this program prior to June 1974 were included in a quarterly series on the HTGR Base Program. The work reported includes the development of unit processes and equipment for reprocessing of High-Temperature Gas-Cooled Reactor (HTGR) fuel, the design and development of an integrated pilot line to demonstrate the head end of HTGR reprocessing using unirradiated fuel materials, and design work in support of Hot Engineering Tests (HET). Work is also described on trade-off studies concerning the required design of facilities and equipment for the large-scale recycle of HTGR fuels in order to guide the development activities for HTGR fuel recycle.

6029 (GA-A—14510) **Design evaluation of the 20-cm (8-inch) secondary burner system.** Rode, J.S. (General Atomic Co., San Diego, Calif. (USA)). Aug 1977. Contract EY-76-C-03-0167-053. 161p. Dep. NTIS, PC A08/MF A01.

This report describes an evaluation of the design of the existing 20-cm (8-inch) engineering-scale secondary burner system in the HTGR reprocessing cold pilot plant at General Atomic Co. The purpose of this evaluation is to assess the suitability of the existing design as a prototype of the HTGR Recycle Demonstration Facility (HRDF) secondary burner system and to recommend alternatives where the existing design is thought to be unsuitable as a prototype. This evaluation has led to recommendations for the parallel development of two integrated design concepts for a prototype secondary burner system. One concept utilizes the existing burner heating and cooling subsystems in order to minimize development risk, but simplifies a number of other features associated with remote maintenance and burner operation. The other concept, which offers maximum cost reduction, utilizes internal gas cooling of the burner, retains the existing heating subsystem for design compatibility, but requires considerable development to reduce the risk to acceptable limits. These concepts, as well as other design alternatives, are described and evaluated.

6030 (NP—22631/1/1) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume I. General overview, Part 1.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 31 Jan 1977. 236p. Energy

Resource Conservation and Development Commission, Sacramento, CA.

Presentations were made on the role of the NRC in reprocessing and waste management, management of commercial radioactive waste and reprocessing, statement by EPA on radioactive waste disposal and nuclear fuel reprocessing, description and history of West Valley reprocessing facility, the work of the Government Accounting Office on issues of nuclear fuel reprocessing and waste disposal; and perspective of the Western Interstate Nuclear Board. The supplemental testimony and materials submitted for the record are included. (LK)

6031 (NP—22631/2/2) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume II. General overview. Part 2.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 1 Feb 1977. 638p. Energy Resources Conservation and Development Commission, Sacramento.

Presentations were made by members of the utility and industry panels on: (1) California utilities and the nuclear statutes; (2) utility technical statement on reprocessing of spent nuclear fuel and management of nuclear wastes from light water reactors; (3) basic questions of high-level waste disposal; (4) corporate experience in the nuclear fuel-cycle industry; (5) reprocessing of spent nuclear fuel; (6) physical status of AGNS Barnwell nuclear fuel plant; and (7] safeguard requirements and implications and the international nuclear proliferation implication of commercial nuclear fuel plants. Then, following a question/answer period, Dr. Karl Z. Morgan spoke on "The Dilemma of Present Nuclear Power Programs;" Dr. Frank Collins, consultant (Oil, Chemical, and Atomic Workers International Union) spoke on commercial reprocessing; Dr Charles Sayles, Member, Board of Directors (Los Angeles Chapter, American Nuclear Society) commented on nuclear hearings; and Ms. Patricia Dolbeare, representative (U.S. Labor Party) commented on nuclear power. The supplemental testimony and materials submitted for the record are included. (LK)

6032 (NP—22631/3/3) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume III. General overview, Part 3.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 2 Feb 1977. 445p. Energy Resources Conservation and Development Commission, Sacramento, CA.

Testimony was given on the plutonium economy, views of the National Council of Churches on plutonium, reprocessing and disposal of spent fuel, legal implications of Assembly Bills 2820 and 2822, the back-end of the nuclear fuel cycle, and energy production, wastes, and perspective on long-term effects. The supplemental testimony and materials submitted for the record are included. (LK)

6033 (NP—22631/4/1) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Voluem IV. Reprocessing, Part 1.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 7 Mar 1977. 704p. Energy Resource Conservation and Development Commission, Sacramento, CA.

Two witnesses gave technical overviews on spent fuel reprocessing. A six member panel discussed the history and status of reprocessing, including both military and commercial experience. The supplemental testimony and materials submitted for the record included information on operating experience at Savannah River Plant, Hanford, and Idaho Chemical Processing Plant. (LK)

6034 (NP—22631/5/2) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume V. Reprocessing. Part 2.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 8 Mar 1977. 504p. Energy Resources Conservation and Development Commission, Sacramento.

Testimony was presented by a four member panel on the commercial future of reprocessing. Testimony was given on the status of nuclear fuel reprocessing in the United States. The supplemental testimony and materials submitted for the record are included in this report. (LK)

6035 (NP—22631/6/3) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume VI. Reprocessing, Part 3.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 10 Mar 1977. 361p. Energy Resources Conservation and Development Commission, Sacramento, CA.

A technical overview of spent fuel storage was presented. A panel presentation was made on storage of spent fuel assemblies from light water reactors, experience in operation of an independent fuel storage facility, spent fuel storage experience in fuel pools, extending storage capacity of spent fuel pools in light water reactors, general engineering and design consideration for spent fuel storage pool facilities, interim spent fuel storage considerations, and safety and security of spent fuel storage at nuclear fuel cycle facilities. The supplemental testimony and materials submitted for the record on spent fuel storage are included. (LK)

6036 (NP—22631/7/1) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume VII. Waste management, Part 1.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 21 Mar 1977. 776p. Energy Resource Conservation and Development Commission, Sacramento, CA.

Presentations were made on high-level waste management, disposal of radioactive waste in deep salt formations, a public viewpoint of nuclear waste management and reprocessing, high-level waste solidification technology, safety assessments for geologic isolations, and on the US ERDA National Waste Terminal Storage Program. Supplemental testimony and materials submitted for the record are included.

6037 (NP—22631/8/2) **Nuclear fuel reprocessing and high-level waste disposal: informational hearings. Volume VIII. Waste management. Part 2.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 22 Mar 1977. 405p. Energy Resources Conservation and Development Commission, Sacramento.

Testimony was presented on management of high-level liquid waste from military programs at ERDA sites, USGS past and future hydrogeological research programs related to disposal of radioactive waste into geological formations, waste management, waste program alternatives, management of transuranium contaminated waste, handling waste from decommissioned nuclear facilities, and an overview of international programs for radioactive waste management. The supplemental testimony and materials submitted for the record covered radioactive waste disposal and storage of spent fuel assemblies. (LK)

6038 (NP—22631/9/3) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume IX. Waste management, Part 3.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 24 Mar 1977. 308p. Energy Resource Conservation and Development Commission, Sacramento, CA.

The following presentations were made: institutions for effective radioactive waste management, ERDA waste management program; the NRC nuclear waste management programs, EPA's responsibilities and activities in regard to radioactive waste management, and radiological waste management. The supplemental testimony and materials submitted for the record included information on arctic disposal of nuclear waste and a status report on the management of commerical radioactive nuclear wastes. (LK)

6039 (NP—22631/10) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume X. International experience.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 19 Apr 1977. 435p. Energy Resources Conservation and Development Commission, Sacramento.

Two witnesses briefed the State Energy Commission on the German nuclear program and the French situation in fuel reprocessing and waste management. Supplemental testimony and material submitted for the record covered the United Kingdom, Canadian, and Swedish nuclear programs. (LK)

6040 (NP—22631/11/1) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume XI. Public and private roles, Part 1.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 26 May 1977. 435p. Energy Resource Conservation and Development Commission, Sacramento, CA.

Testimony was presented on nuclear waste management and the public policy, social criteria for waste disposal, and position of California electric utilities and industries on existence of techniques for reprocessing and waste disposal. The supplemental testimony and materials submitted for the record are included. (LK)

6041 (NP—22631/12/2) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume XII. Public and private roles, Part 2.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 27 May 1977. 375p. Energy Resource Conservation and Development Commission, Sacramento, CA.

Presentations were made on institutional experiences at Nuclear Fuel Services, the framework for an acceptable nuclear future, the Price-Anderson Indemnity Act, Congress and nuclear energy policy, human dimension, and risk perception. The supplemental testimony and materials submitted for the record included information of the nuclear waste at West Valley, New York, the perception and acceptability of risk from nuclear and alternative energy sources, and psychological determinants of perceived and acceptable risk. (LK)

6042 (NP—22631/13/1) **Nuclear fuel reprocessing and high-level waste management: informational hearings. Volume XIII. Nuclear safeguards, proliferation, and alternate fuel cycles, Part 1.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 13 Jun 1977. 442p. Energy Resources Conservation and Development Commission, Sacramento, CA.

The following presentations were made: overview of safeguards and proliferation concerns, how to develop nuclear power while limiting its dangers, U.S. safeguards and proliferation policies, and an overview of ERDA responses to the changes in national policy. The supplemental testimony and materials submitted for the record are included. (LK)

6043 (NP—22631/14/2) **Nuclear fuel reprocessing and high-level waste management: informational hearings. Voluem XIV. Nuclear safeguards, proliferation, and alternate fuel cycles, Part 2.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 14 Jun 1977. 265p. Energy Resource Conservation and Development Commission, Sacramento, CA.

Prepared testimony was presented on routes to proliferation and diversion, and means of reducing risks and on adequacy of current safeguards and effectiveness of their enforcement. A panel discussed safeguards and proliferation problems and policies. The supplemental testimony and materials submitted for the record are included. (LK)

6044 (NP—22631/15/3) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume XV. Nuclear safeguards, proliferation, and alternate fuel cycles, Part 3.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 16 Jun 1977. 711p. Energy Resource Conservation and Development Commission, Sacramento, CA.

Three presentations were made on available fuel-cycle alteratives. Panel discussions were presented on alternate fuel-cycle programs and on resource and economic implications of a no-reprocessing decision. The supplemental testimony and material submitted for the record are included. (LK)

6045 (NP—22631/16/4) **Nuclear fuel reprocessing and high level waste disposal: informational hearings. Volume XVI. Nuclear safeguards, proliferation, and alternate fuel cycles, Part 4.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 17 Jun 1977. 387p. Energy Resource Conservation and Development Commission, Sacramento, CA.

A panel discussed non-proliferation safeguards improvements in fuel cycles. Presentations were made on non-proliferation implications of alternate nuclear technologies, vulnerability of nuclear fuel cycles to malevolence, non-proliferation alternatives, and status of federal schedules and plans in the back-end of the fuel cycle. The supplemental testimony and materials submitted for the record covered plutonium analysis, possible optimum use of thorium and uranium employing crossed-progeny fuel cycles, and economically optimum plutonium lattices for water reactors. (LK)

6046 (NUREG—0278(Vol.1)) **Technology, safety, and costs of decommissioning a reference nuclear fuel reprocessing plant.** Schneider, K.J.; Jenkins, C.E.; Rhoads, R.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1977. 366p. NTIS $12.50.

Safety and cost information were developed for the conceptual decommissioning of a fuel reprocessing plant with characteristics similar to the Barnwell Nuclear Fuel Plant. The main process building, spent fuel receiving and storage station, liquid radioactive waste storage tank system, and a conceptual high-level waste-solidification facility were postulated to be decommissioned. The plant was conceptually decommissioned to three decommissioning states or modes; layaway, protective storage, and dismantlement. Assuming favorable work performance, the elapsed time required to perform the decommissioning work in each mode following plant shutdown was estimated to be 2.4 years for layaway, 2.7 years for protective storage, and 5.2 years for dismantlement. In addition to these times, approximately 2 years of planning and preparation are required before plant shutdown. Costs, in constant 1975 dollars, for decommissioning were estimated to be $18 million for layaway, $19 million for protective storage and $58 million for dismantlement. Maintenance and surveillance costs were estimated to be $680,000 per year after layaway and $140,000 per year after protective storage. The combination mode of protective storage followed by dismantlement deferred for 10, 30, and 100 years was estimated to cost $64 million, $67 million and $77 million, respectively, in nondiscounted total 1975 dollars. Present values of these costs give reduced costs as dismantlement is deferred. Safety analyses indicate that radiological and nonradiological safety impacts from decommissioning activities should be small. The 50-year radiation dose commitment to the members of the public from airborne releases from normal decommissioning activities were estimated to be less than 11 man-rem.

6047 (NUREG—0278(Vol.2)) **Technology, safety, and costs of decommissioning a reference nuclear fuel reprocessing plant.** Schneider, K.J.; Jenkins, C.E.; Rhoads, R.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1977. vp. NTIS $14.00.

Volume 2 comprises six appendices on: facility description; residual radioactivity inventory estimates; description and contamination levels of reference site; derivation of residual contamination levels; decommissioning mode detail; and decommissioning safety assessment details.

6048 (ORNL/TM—5993) **Advanced fuel recycle program progress report, April 1—June 30, 1977.** Unger, W.E. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. vp. .

This quarterly progress report on the Fuel Recycle Program covers the ongoing development program aimed at providing the technology for production-scale advanced fuels recycle. The continuing basic laboratory and hot-cell studies, engineering research, and component equipment development activities are in support of a cold integrated equipment test scheduled for 1981 and a current conceptual design of a hot experimental facility scheduled for operation in 1988.

6049 (RFP—2591) **Alternate fuel cycle technologies, nitrate-to-oxide conversion project. Progress report, January—June 1977.** Lehmkuhl, G.D. (Atomics International Div., Golden, Colo. (USA). Rocky Flats Plant). 2 Sep 1977. Contract EY-76-C-04-3533. 68p. Dep. NTIS, PC A04/MF A01.

Work is being done at the Rocky Flats Plant (RFP) under contract from the Savannah River Operations Office (SROO) of the U.S. Energy Research and Development Administration (ERDA) to critically analyze and evaluate existing technology for converting plutonium nitrate to plutonium oxide, and to recommend flow sheets and equipment for this process. Seven such processes were compared using an expanded process-comparison scheme. The results of the comparison differed somewhat from the initial comparison made in September, 1976. The direct calcination methods, headed by the screw calciner process, received the highest ratings when operating experience was considered with a small weighting factor. These methods are much simpler than the others. The oxalate precipitation methods, headed by the plutonium(IV) oxalate precipitation and calcination process, received highest ratings when operating experience was strongly considered. Thus, in the long term, the screw calciner or other direct-conversion methods should be developed. For a plant to be built in the short term, however, an oxalate precipitation method should be used since a larger amount of experience exists with these processes. The block flow diagrams, material balances, and equipment flow sheets for each of the seven processes compared are included in this report. A process-design criterion is being prepared for a mechanical (screw calciner) direct-denitration process, and includes process flow sheets, a material balance, a process description, equipment performance specifications, the control philosophy and specifications, the operating philosophy, and a general process layout.

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 6030, 6031, 6032, 6033, 6034, 6035, 6036, 6037, 6038, 6039, 6040, 6041, 6042, 6043, 6044, 6045

6050 (BNL—50694) **Waste management and proliferation: an assessment of technologies and policies relevant to nuclear power. Final report, June 1975—March 1977.** Goldstein, M.K.; Anderson, R.N.; Selvaduray, G.; Gangwer, T.; Braun, C.; Goellner, D.; Malone, R.; Sevian, W.A.; Lester, R. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 135p. Dep. NTIS, PC A07/MF A01.

Some of the long-term hazards from radioactive waste management and the problems in safeguarding plutonium in a world moving toward a plutonium economy are presented. To ameliorate these problems, several alternative fuel cycle options are presented: homogeneous reactor, denatured thorium, open, tandem, accelerator-regenerative, co-processing, plutonium, spiking, and partitioning. An assessment is made of a variety of separation technologies applied to these options, including a review of 32 different reprocessing methods. The effects of these options on both U.S. and transnational policies regarding waste management and proliferation are examined. This study addresses the transnational environmental policy issues created by a worldwide nuclear industry and suggests the need for two international organizations: one to manage spent fuel and the breeder fuel cycle; the second to protect the global environment. Two photochemical schemes for improving existing reprocessing technology by reducing wastes and materials unaccounted for (MUF) are presented. The applicability of this technology, along with column chromatography, Talspeak, and other separation methods, is examined relative to various waste management alternatives including the partitioning and transmutation option. A computer model to determine the effectiveness of transmutation as a

function of separation efficiency has been developed and employed. To estimate health impacts from various fuel cycle options, the Brookhaven energy system network simulator has been integrated with an atmospheric dispersion and pathway analysis model. Using revised ^{222}Rn emission data, it is estimated from the linear hypothesis that the number of excess cancers is slightly less for the open than for the closed cycle. More importantly, the number of excess cancers induced by mill and mine tailings is from one to two times that caused by the rest of the entire fuel cycle.

6051 (ORNL—5226) **Guide to radioactive waste management literature.** Houser, B.L.; Holoway, C.F.; Madewell, D.G. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 345p. Dep. NTIS, PC A15/MF A01.

Increased public concern about radioactive waste management has called attention to this aspect of the nuclear fuel cycle. Socio-economic planning and technical development are being undertaken to assure that such wastes will be managed safely. This Guide to Radioactive Waste Management Literature has been compiled to serve scientists, engineers, administrators, legislators, and private citizens by directing them to sources of information on various aspects of the subject. References were selected from about 6000 documents on waste management in the computerized information centers in Oak Ridge. The documents were selected, examined, indexed, and abstracted between 1966-1976 by several knowledgeable indexers, principally at the Nuclear Safety Information Center. The selected references were further indexed and classified into 12 categories. Each category is discussed in enough detail to give some understandng of present technology in various phases of waste management and some appreciation of the attendant issues and problems. The bibliographic part of this guide exists in computerized form in the Health Physics Information System and is available through the Oak Ridge Information Center Complex for searching from remote terminals.

6052 (BNWL-tr—264) **Management of radioactive waste in Belgium.** Dejonghe, P. (International Atomic Energy Agency, Vienna (Austria)). 1977. Translation of Belgian report. (CONF-770505—215(trans.)). 23p. Dep. NTIS, PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

BelgoWaste Research Syndicate was formed in 1975 to carry out a technico-economic and legal study of radioactive waste in Belgium and to prepare the constitution of an organization charged with managing these wastes. This paper summarizes the results of the first phase of the study, which was devoted to an inventory of the radioactive waste for different development scenarios for the nuclear industry in Belgium. A project was established to detail the treatment and conditioning processes and the capacities of the projected installations.

6053 (MLM—2454(TR)) **Radioactive residues. Current and prospective problems.** Gauvenet, A. Translated from *Rev. Gen. Nucl.;* **1**: No. 2, 113-118(1975). 22p. Dep. NTIS, PC A02/MF A01.

After having described the principal characteristics of radioactive residues, the author examined the current problems posed by liquid and gaseous effluents and stressed that nuclear installations are definitely much less polluting, with an identical power output, than conventional power stations. Research programs have been undertaken in the face of the predictable increase in activity. The gist of the matter is to maintain the absorbed doses at their present level and to study the problem of compounds with a long lifetime, the accumulation of which would create considerable danger on a world scale. With respect to the stockpiling of wastes, the author described the various techniques currently used and cited studies in progress, some of which—such as vitrification—have already come into the first stages of application. After having noted that the waste problem undoubtedly constitutes a technical difficulty and perhaps even more so on the psychological plane, the author defined in conclusion the conditions that should be established so that this problem does not hinder the short- and long-term development of nuclear energy.

WASTE PROCESSING

6054 (HEDL-TME—77-40) **Division of Waste Management, Production, and Reprocessing programs progress report for January—December 1976.** Lerch, R.E. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Apr 1977. Contract EY-76-C-14-2170. 145p. Dep. NTIS, PC A07/MF A01.

Development of the acid digestion process for treating combustible nuclear wastes has progressed to design and construction of the Radioactive Acid Digestion Test Unit (RADTU). Tests were continued in the nonradioactive Acid Digestion Test Unit (ADTU) in an effort to improve the performance of the system. Nitric acid consumption has been decreased from 8.8 to 4.5 kg HNO_3/kg digested waste by adding the nitric acid deep below the liquid surface in the annular heating vessel instead of at the surface of the tray digester. A highly successful 70-hr continuous processing run was completed in the ADTU to confirm the operating experience in shorter runs and to test the use of air (instead of nitrogen) in the airlift pump. Initial studies were completed on fixation of acid digestion residue following recovery and drying. A variety of solidification and testing equipment was assembled to prepare and test immobilized waste products. Studies were continued on immobilization of salts and wet wastes. Salt residue-cement systems characterized include calcium sulfate, ferric sulfate, sodium sulfate, sodium nitrate, calcium chloride, and sodium chloride. Anion and cation exchange resin immobilization in cement has also been studied, as well as immobilization of sodium silicate in cement. A new program on Intermediate Level Liquid Waste (ILLW) Solidification was started with the purpose of developing and demonstrating immobilization technologies for liquid and particulate solid ILW within the fuel cycle. The four primary fuel cycle operations (reactors, spent fuel storage basins, fuel reprocessing plants, and MOX fuel fabrication plants) were reviewed and a list of sources and quantities of waste was formulated. The annual accumulation of radioactive waste materials at the six commercial waste burial sites was updated through 1976. The total accumulated volume at the end of 1976 was about 434,000 m^3. (LK)

6055 (HEDL-TME—77-74) **Division of Waste Management, Production, and Reprocessing programs progress report for January—June 1977.** Lerch, R.E. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jul 1977. Contract EY-76-C-14-2170. 90p. Dep. NTIS, PC A05/MF A01.

Construction of the 100-kg/day Radioactive Acid Digestion Test Unit (RADTU) facility was completed in June 1977 with the exception of the acid recycle mode, which is being added to the originally planned unit. Engineering tests of the acid recycle flowsheet, using test equipment one-quarter scale of the proposed acid recycle addition to RADTU, confirmed the validity of the zero effluent flowsheet proposed for RADTU. Studies were continued on immobilization of wastes in cement. Cement products containing up to 16 wt percent boric acid were successfully made and tested for compressive strength. The thermal characteristics of various waste products were determined using a differential scanning calorimeter. The ignition temperatures for bitumen and bitumen products containing salts, including sodium nitrate, were found to be about 400°C. There was no significant lowering of the ignition temperature below that of bitumen itself upon incorporation of these salts into bitumen. Urea-formaldehyde products exhibited ignition temperatures around 300°C. Ignition temperatures of resins (anion and cation) were relatively high (400 to 600°C) except for anion exchange resin in the nitrate form which ignited about 250°C. Leach tests were performed on various waste products immobilized in cement, urea-formaldehyde, and bitumen. The results indicated that cement solids exhibited the lowest leach rates for leaching of uranyl nitrate from immobilized anion exchange resin and from immobilized acid digestion residue. Leach rates of cesium and strontium from immobilized anion exchange resin were lowest for bitumen products. Work is proceeding on development of a process to reduce the volume of mercuric nitrate - nitric acid off-gas scrub solution without loss of the iodine. Preliminary results are promising and indicate that volume reductions of at least 10-fold can be achieved with as little as 0.01 percent of the iodine being volatilized.

6056 (ICP—1130) **Evaluation of methods for immobilizing solids loaded with krypton-85.** Benedict, R.W. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Aug 1977. Contract EY-76-C-07-1540. 27p. Dep. NTIS, PC A03/MF A01.

Seven methods of immobilizing solid granules loaded with krypton-85 are evaluated for krypton leakage, radiation resistance, physical strength, and heat transfer. The methods use (1) glass matrices, (2) metal matrices, (3) polymer matrices, (4) pressed (isostatic) matrices, (5) cement blocks, (6) bitumen blocks, and (7) porous metal containers. The sintered-metal matrices, polymer matrices, pressed (isostatic) matrices and porous metal containers are the most promising methods. Further development work is needed to determine the volume increase and krypton leakage rate of the immobilized solid.

6057 (MLM—2452) **Volume reduction of tritiated liquid wastes with super slurper.** Condron, M.A.; Freeman, S.S. (Mound Lab., Miamisburg, Ohio (USA)). 14 Oct 1977. Contract EY-76-C-04-0053. 9p. Dep. NTIS, PC A02/MF A01.

A method of packaging low-specific-activity tritiated waste water was developed which could reduce the volume of this kind of waste shipped from Mound Laboratory by 20 percent. This was accomplished by reducing the amounts of cement and attapulgite which are currently added to the waste water for immobilization and adding a highly adsorbent polymer called super slurper.

6058 (ORNL/TM—5826) **Separation of radioactive krypton from carbon dioxide and oxygen with molecular sieves.** Forsberg, C.W. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 75p. Dep. NTIS, PC A04/MF A01.

In the reprocessing of HTGR nuclear fuels, the off-gas cleanup system generates a stream containing about 1 percent krypton, 90+ percent CO_2, and various amounts of O_2, N_2, and xenon. The krypton is radioactive and must be separated from the CO_2 before it is bottled or zeolite-encapsulated for final disposal. A series of theoretical and experimental investigations to find the best method for separating CO_2 and krypton under the required conditions showed that 5A molecular sieves near $0^{\circ}C$ and 1.01×10^5 Pa (1 atm) provided the most effective separation. Molecular sieves are powerful solid adsorbents for CO_2 but weak adsorbents for krypton. For a typical expected CO_2-O_2-krytpon gas mixture, a molecular sieve bed adsorbs the CO_2, allows the O_2 to pass freely through the bed, and concentrates the krypton before it exits the bed. The process selected and investigated is called frontal analysis gas chromatography.

6059 (RFP—2667) **Waste management analysis for the nuclear fuel cycle: parts I and II. Progress report for period ending March 31, 1977.** Thompson, G.H.; Cash, D.L.; Childs, E.L.; Navratil, J.D.; Martella, L.L.; Plock, C.E. (Atomics International Div., Golden, Colo. (USA)). 21 Sep 1977. Contract EY-76-C-04-3533. 24p. Dep. NTIS, PC A02/MF A01.

Preliminary evaluation of leaching, acid digestion, and fusion methods for actinide recovery from incinerator ash was begun. Cold ash from the fluidized bed incinerator was used as a stand-in for contaminated ash being prepared. Solubilization of ash was used as the measure of method efficiency. Fusion with basic fluxes appears to be most promising both with respect to actinide recovery efficiency and minimum impact on waste volume and form. Evaluation was begun of methods and recycle preparation problems for salt waste and waste water streams. A feasibility study for removing actinides from the salt wastes with a bidentate organophosphorous extractant was initiated. The composition of these waste streams was defined and actinide extraction coefficients, using dihexyl-N, N-diethylcarbamylmethylene phosphonate as the extractant, were determined as a function of nitric acid concentration. For the waste water streams, preliminary flow sheets were developed for purifying water by reverse osmosis.

6060 **Two-step flash technique for vaporizing radioactive liquids.** Rajakovics, G.E.; Gabernig, H.; Klein G.P. (to Vereinigte Delstahlwerke AG.). US Patent 4,043,875. 23 Aug 1977. Priority date 2 Feb 1972, Austria. 8p.

An improved technique employing first and second flash vaporization stages for purifying radioactive liquids is described. The liquid is first flash-evaporated in the first vaporization stage and the resulting vapor is conducted to a first direct condenser. Enriched liquid obtained from the second vaporization stage is applied via a circulating pump to the first direct condenser to condense by contact the vapor from the first vaporization stage and to form a mixture with this condensate. The resulting mixture is thus flash-evaporated in the second vaporization stage. A portion of the enriched liquid obtained from the second vaporization stage is withdrawn from the loop formed by said second vaporization stage, said circulating pump, said first direct condenser, and the connecting conduits therebetween for further processing, e.g., recycling to the first vaporization stage, or for discharging.

6061 **Process and apparatus for the concentration and storage of liquid radioactive wastes.** Szivos, K.; Lovass, G.; Liptak, L.; Hirling, J.; Pavlik, O. (to Magyar Tudomanyos Akademia Isotop Intezete). US Patent 4,040,973. 9 Aug 1977. Filed date 3 Jan 1974. 8p.

Liquid radioactive wastes are concentrated to form a pasty radioactive concentrate by evaporation below the boiling point of the waste by injecting a hot gaseous medium tangentially in a vortex stream over the entire surface of the liquid waste, thereby entraining vapor evaporated from the liquid surface, removing the gaseous medium together with the entrained vapor, drying and reheating the removed gaseous medium and recirculating it in a vortex stream over the surface of the waste, which may then be stored in the same container in which the evaporation took place.

6062 **Activation of water soluble amines by halogens for trapping methyl radioactive iodine from air streams.** Deitz, V.B.; Blachly, C.H. (to Energy Research and Development Administration). US Patent 4,040,802. 9 Aug 1977. Filed date 22 Apr 1975. 4p.

PAT-APPL-570,925.

Gas adsorbent charcoals impregnated with an aqueous solution of the reaction product of a tertiary amine and elemental iodine or bromine are better than 99% efficient in trapping $CH_3{}^{131}I$. The chemical addition of iodine or bromine to the tertiary amine molecule increases the efficiency of the impregnated charcoal as a trapping agent, and in conjunction with the high flash point of the tertiary amine raises the ignition temperature of the impregnated charcoal.

6063 (ORNL-tr—4419) **Experience acquired in regard to evaporating liquid radioactive waste and solidifying evaporation sludge at the Centres D'Etudes Nuclearies de Fontenay-aux-Roses and de Grenoble.** de Robien, E.; Pomarola, J.; Brodsky, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1966. Translation by S.D. Blalock, Jr. from pp 279—290 of STI/PUB—116. (CONF-651202—48). 10p. Dep. NTIS, PC A02/MF A01.

From Symposium on practices in the treatment of low and intermediate level radioactive waste; Vienna, Austria (6 Dec 1965).

The evaporators used at the radioactive effluent processing stations of the Grenoble and Fontenay-aux-Roses Centres have been in operation since September 1962 and February 1965, respectively. The reasons for selecting the evaporation method are given, reference being made to the regulations governing disposal of liquid effluents. After a comparative description of the characteristics of the two installations, the paper describes the experience gained in the course of operation, discussing: concentration factors; decontamination factors; precautions taken to avoid corrosion risks; and difficulties encountered, modifications and improvements made. Laboratory studies carried out on the solidification of sludges are described as well as the various stages leading to the completion of the present installations. Finally, the authors present an economic assessment.

WASTE DISPOSAL AND STORAGE

REFER ALSO TO CITATION(S) 6061, 6078, 7126, 7259

6064 (NUREG—0326) **Workshop material for state review of USNRC site suitability criteria for high-level radioactive waste repositories.** (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Material Safety and Safeguards). Aug 1977. 29p. NTIS $4.00.

The Nuclear Regulatory Commission (NRC) is developing criteria on which to judge whether a proposed site for a geologic repository is suitable for disposal of high-level nuclear wastes. To aid in its analysis and assessment, NRC is planning three early independent reviews of the site suitability criteria development effort: a peer review by experts outside of NRC; a review by the National Academy of Sciences; and a review by State officials. This document has been prepared to aid workshop participants in understanding the Preliminary Site Suitability Criteria and to prepare them to contribute to an evaluation of those criteria. (LK)

6065 (NUREG—0353) **Workshops for state review of site suitability criteria for high-level radioactive waste repositories. Discussion Group reports.** (Nuclear Regulatory Commission, Washington, D.C. (USA)). Oct 1977. vp. NTIS $8.00.

The NRC Waste Management Program and the Office of State Programs held three regional workshops to solicit ideas from State executives and legislators on the siting and licensing procedures for high level waste repositories and to solicit comments on the NRC preliminary site suitability criteria. The workshops were held in Denver, Colorado; New Orleans, Louisiana; and Philadelphia, Pennsylvania during the period 19-30 September 1977. The reports from these workshops are contained herein. The workshops were attended by 170 invited State executives and legislators from 46 states. In addition, there were over 80 observers from diverse backgrounds including the general public, government, industry, professional consultants and university faculty. The workshops were announced in the Federal Register on September 1, 1977 (42 FR 41044).

6066 (RHO-CD—80) **Evaluation of the 241-S-111 salt well jet pump prototype.** Dixon, D.R. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1 Sep 1977. Contract EY-76-C-06-2130. 27p. Dep. NTIS, PC A03/MF A01.

The jet pump system installed in Tank 241-S-111 has operated for five months since installation in January 1976. When the pump failed in January 1977, 247,000 gallons of liquor had been pumped with a final pumping rate of 0.5 to 0.6 GPM (approximately 800 GPD). It is estimated that the tank has 126,300 gallons remaining of which 76,200 gallons is drainable (the remaining is held by capillary forces). With the present jet pump design, an estimated pumping rate of .05 GPM would be the minimum that could be achieved. An additional 220 days of continuous pumping is predicted to reach this minimum rate. Several operating problems have hampered production from the jet pump system. A mathematical model based on the Darcy radial flow equation has been developed to predict the inflow rate of liquor to a salt well. Using the data from 111-S, the empirical constant necessary to use this equation was determined. This constant, defined as the ratio of the salt cake permeability to the liquor viscosity (k/μ), ranged from 0.3 to 1.0 Darcy/centipoise. Assuming that the sludge does not allow liquid to flow through it, the k/μ ratio was found to be 0.8. The porosity of the salt cake was found to be 0.30, which agrees with previous estimates.

6067 (UCRL—13770) **Determination of a radioactive waste classification system. Final report.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Sep 1977. Contract W-7405-ENG-48. 102p. Dep. NTIS, PC A06/MF A01.

A description of low-level waste disposal facilities, calculational methods for determining interface levels, results of the evaluations, formulation of waste classification system interfaces, and how to use the waste classification system are presented. Six appendices provide additional information.

6068 (Y/DD—238(Rev.)) **Assessment of solid low-level radioactive waste management.** Sanders, M. (Oak Ridge Y-12 Plant, Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 29p. Dep. NTIS, PC A03/MF A01.

This report describes solid, low-level radioactive waste management programs at the Oak Ridge Y-12 Plant. The discussion includes methods of operation, monitoring activities in and around burial facilities, and an environmental assessment of the operation.

6069 (Y/OWI/SUB—3745/7) **In situ dissolution of marine evaporite: principles and concepts.** Piper, A.M. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Office of Waste Isolation). Mar 1973. Contract W-7405-ENG-26. 21p. Dep. NTIS, PC A02/MF A01.

Evaporites of marine origin, the solid deposits from a desiccating or desiccated area of a sea, are moderately plentiful among the rocks of the Earth's crust. Commonly, however, they exist in minimal quantity only, if at all, at and near outcrops of the stratigraphic horizons at which evaporites are known to occur at depth; evidently, at and near such outcrops and evaporites have been removed by dissolution in situ. This paper undertakes to identify, in general terms, the agents and factors of such dissolution.

6070 (Y/OWI/TM—40) **Responses to published statements in Louisiana on the Nuclear Waste Disposal Program, March—July 1977.** (Union Carbide Corp., Oak Ridge, Tenn. (USA). Office of Waste Isolation). 31 Aug 1977. Contract W-7405-ENG-26. 26p. Dep. NTIS, PC A03/MF A01.

A series of statements taken from Louisiana newspapers are clarified or corrected. The majority of the statements were made by Dr. J. Robert Kemmerly, a Minden, Louisiana, physician, Mr. R. H. Manning of Minden, Louisiana, and Representative L. G. LaPlante of Cutoff, Louisiana. (LK)

6071 (Y/OWI/TM—42) **Maximum acceptable temperatures of wastes and containers during retrievable geologic storage.** Jenks, G.H. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Office of Waste Isolation). 17 Aug 1977. Contract W-7405-ENG-26. 7p. Dep. NTIS, PC A02/MF A01.

Estimates of maximum acceptable temperatures of waste and containers during retrievable geologic storage were needed for use in evaluating and comparing conceptual designs for repositories for wastes from reprocessing and for spent fuel in several different rock types. Estimates of these temperatures and discussions of the bases for the estimates are presented.

6072 **Radioactive waste: society's problem child.** Lapp, R.E. Greenwich, CT; Reddy Communications Inc. (1977). 116p. .

The nuclear waste disposal issue has been explored in this book, and an attempt has been made to present evidence to dissolve some of the mystery that surrounds the disposal issue. Some of the technical background for understanding the issue is set forth, quotations from numerous people are cited, and a series of questions that a layperson might ask are posed. The book is divided into 3 sections entitled: A Close Look at the Issues-and a Solution; Questions and Answers about Nuclear Waste Disposal; and Radiation Risks in Perspective. [BLM]

6073 (ORNL-tr—4444) **Land requirement for a radioactive waste disposal yard.** Inoue, Y.; Morisawa, S. Translated by A. Bach from *Nippon Genshiryoku Gakkaishi;* **18**: No. 5, 44-51(1976). 13p. Dep. NTIS, PC A02/MF A01.

Land requirement for a radioactive waste disposal site was discussed from the viewpoint of preserving the radiological safety of public citizens, which might be caused by the buried wastes through radioactive contamination of water and soil around the disposal yard in a nuclear facility. A two-dimensional transportation diffusion equation, which was used for estimating a ^{90}Sr distribution in a saturated zone around the waste disposal yard, was analyzed numerically with an aid of high speed digital computer. Those environmental parameters such as velocity of groundwater, diffusion coefficient, equilibrium distribution factor of ^{90}Sr and so on were assumed to be given at the nuclear site through a preliminary site survey. Direct drinking of groundwater and intake of vegetables cultivated using groundwater were assumed as major intake routes of ^{90}Sr leaked from buried wastes and two types of land use restriction area were proposed. The first restriction area, where any kind of groundwater use was to be forbidden, was set around the disposal yard for making sure not to have an internal irradiation dose caused by the wastes more than the dose limit for the public. The second restriction area was set around the first restriction area and the groundwater was not to be used for irrigation.

6074 (ORNL-tr—4443) **Radionuclide migration in aerated zones. II. Migration characteristics of Sr-90 leached out from cemented solid.** Inoue, Y.; Morisawa, S.; Mahara, Y. Translated by A. Bach from *Nippon Genshiryoku Gakkaishi;* **18**: No. 9, 54-59(1976). 10p. Dep. NTIS, PC A02/MF A01.

Strontium-90 solidified with portland cement was set in the model column of aerated zone, which should be used for actual burial of radioactive wastes. Tap water was fed on the surface of the aerated zone through spray nozzle, and the leaching of ^{90}Sr from a cemented solid and the migration through sand bed were tested by measuring ^{90}Sr concentration distribution. Some valuable results have been obtained: (1) water quality of infiltration water through sand bed changes in pH and Ca + Mg concentration. The change of pH in infiltration water would be used as a preceding indicator for predicting the ^{90}Sr migration. (2) Saturation degree of soil pore with water rises up to an equilibrium value relating to a feed rate of water. Equilibrium saturation degree increases with depth slightly. (3) Migration depth of ^{90}Sr is deepest beneath the cemented solid.

6075 (ORNL-tr—4441) **Migration of radionuclides in a model saturated zone. II. Comparison of strontium-90 distribution between predicted and observed.** Inoue, Y.; Morisawa, S. Translated by A. Bach from *Nippon Genshiryoku Gakkaishi;* **18**: No. 6, 44-50(1976). 11p. Dep. NTIS, PC A02/MF A01.

In the previous paper, transportation of ^{90}Sr which leached out from cemented solid into a model saturated stratum was experimentally discussed. In this paper, two kinds of techniques were examined for predicting the ^{90}Sr distribution in a model stratum. The first technique consists of numerical solution of a transportation-diffusion equation, which describes the transportation phenomena of ^{90}Sr in the stratum. The second one consists of time-transformation technique which predicts a ^{90}Sr distribution in the stratum based on the distribution of a tracer of water such as tritiated water (HTO). Some significant results have been obtained, such as that: (1) the first technique has, at present, some difficulties in predicting a ^{90}Sr distribution. The difference between a predicted and an observed ^{90}Sr distribution should be minimized through taking into consideration local disturbance of stratum characteristics. The mathematical model should also be checked on the usefulness for predicting by using a HTO tracer test agree well with an observed distribution. (2) The ^{90}Sr distribution predicted by using a HTO tracer test agree well with an observed distribution. It takes only about $^{1}/_{50}$ of the time which would be required for actual distribution of ^{90}Sr in the stratum.

6076 (ORNL-tr—4440) **Migration of radionuclides in a model saturated zone. I. Experiments and discussion.** Inoue, Y.; Morisawa, S. Translated by A. Bach from *Nippon Genshiryoku Gakkaishi;* **18**: No. 1, 42-50(1976). 14p. Dep. NTIS, PC A02/MF A01.

Leaching of radionuclides from solidified waste and their migration characteristics are tested using a model sand layer, whose depth is 50 cm, width 40 cm, length 105 cm and consists of 306 kg sand taken from Japan Atomic Energy Research Institute, Tokai Site. Model solidified waste (19.6 cm diameter and 50 cm height), solidified with portland cement containing seven nuclides (^{90}Sr, ^{137}Cs, ^{60}Co, ^{65}Zn, ^{54}Mn, ^{59}Fe and /sup 110m/Ag), is set in the saturated sand layer and the concentration of nuclides in a pore water of the layer is checked after specific intervals of time. After about 1,280 days, the saturated sand layer is taken to pieces and a distribution of a nuclide in a bedded sand is also checked. The results obtained through this experiment are as follows: (1) Among seven radionuclides, only ^{90}Sr is detected in both pore water and bedded sand. (2) The distribution of ^{90}Sr in a pore water of the layer becomes steady after about 500 days. This steady distribution is closely related to the steady leaching of ^{90}Sr out of solidified waste. (3) First stage leaching of ^{90}Sr out of solidified waste soon after the contact with water is large, but it results in flat distribution rapidly as the nuclide migrates through a sand layer, which means a large ^{90}Sr exchange capacity of bedded sand. (4) Theory of K/sub f/ factor depicts well a migration rate of ^{90}Sr in a model saturated sand layer.

6077 (ORNL-tr—4442) **Radionuclide migration in aerated zones. I. Migration characteristics of nuclides contained in percolating water.** Inoue, Y.; Morisawa, S.; Mahara, Y. Translated by A. Bach from *Nippon Genshiryoku Gakkaishi;* **17**: No. 7, 50-58(1975). 15p. Dep. NTIS, PC A02/MF A01.

If it is desired to evaluate the potential hazard caused by radioactive wastes buried in the ground, it is necessary to know how radionuclides would migrate through soil especially through aerated zones. However, the rate of underground migration of nuclides has so far been studied far less extensively in aerated zones than in saturated zones, on account of many difficulties underlying such studies. The present paper covers an experimental study based on a model stratum, aimed at obtaining information on phenomena occurring in an aerated zone. Some significant results have been obtained, such as that: (1) The concept of time-transformation factor (K/sub f/-factor) is useful in the present circumstances for evaluating the migration of nuclides in aerated zones, (2) radionuclides would be retained in an aerated zone at least as effectively as in a saturated zone, and (3) the movement of ^{90}Sr in an aerated zone could be

predicted from the observed behavior of ^{90}Y, which is a daughter of ^{90}Sr, because ^{90}Y migrates faster than ^{90}Sr.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 6024, 6068, 7415, 7513

6078 (UCRL—13771) **Generic environmental assessment for implementing a radioactive waste classification system.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Sep 1977. Contract W-7405-ENG-48. 19p. Dep. NTIS, PC A02/MF A01.

Potential impact on the environent, compliance with applicable water and air quality standards, cost-benefits due to the interface, unavoidable adverse effects, alternatives to the proposed action, and irreversible commitments of resources are discussed. (LK)

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 6073, 7418, 7432, 7510, 7511, 7512, 7513

6079 (UCID—17565) **Final Safety Analysis Report (FSAR) for Building 332, Increment III.** Odell, B.N.; Toy, A.J. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Aug 1977. Contract W-7405-ENG-48. 175p. (P). Dep. NTIS, PC A08/MF A01.

This Final Safety Analysis Report (FSAR) supplements the Preliminary Safety Analysis Report (PSAR), dated January 18, 1974, for Building 332, Increment III of the Plutonium Materials Engineering Facility located at the Lawrence Livermore Laboratory (LLL). The FSAR, in conjunction with the PSAR, shows that the completed increment provides facilities for safely conducting the operations as described. These documents satisfy the requirements of ERDA Manual Appendix 6101, Annex C, dated April 8, 1971. The format and content of this FSAR complies with the basic requirements of the letter of request from ERDA San to LLL, dated March 10, 1972. Included as appendices in support of th FSAR are the Building 332 Operational Safety Procedure and the LLL Disaster Control Plan.

REGULATIONS

REFER ALSO TO CITATION(S) 6943

ACCOUNTABILITY AND SAFEGUARDS

REFER ALSO TO CITATION(S) 6050, 6895, 6898, 6899

6080 (BNWL-SA—6113) **Mobile nondestructive assay verification and measurement system.** Brauer, F.P.; Fager, J.E.; Kaye, J.H.; Sorenson, R.J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1977. Contract EY-76-C-06-1830. 16p. Dep. NTIS, PC A02/MF A01.

A mobile, real-time, nondestructive assay system has been developed for both nuclear material safeguards inventory verifications and measurements on the Hanford project. The system includes electronic and computer support equipment mounted in a specially constructed vehicle, and passive and active neutron and gamma-ray measurement equipment transported in the vehicle but operated external to the vehicle. This system significantly increases safeguards verification and measurement capabilities.

6081 (ERDA—77-68) **Report on strategic special nuclear material inventory differences.** (Energy Research and Development Administration, Washington, D.C. (USA)). Aug 1977. 237p. Dep. NTIS, PC A11/MF A01.

Information concerning accounting for significant quantities of strategic special nuclear material (SSNM) in ERDA facilities is reported. Inventory difference data are provided for fiscal year 1976 for ERDA and ERDA contractor facilities that possessed significant quantities of SSNM. (LK)

6082 (LA—6788PR) **Nuclear safeguards research program status report. Progress report, September—December 1976.** Sapir, J.L. (comp.). (Los Alamos Scientific Lab., N.Mex. (USA)). Jun 1977. Contract W-7405-ENG-36. 54p. Dep. NTIS, PC A04/MF A01.

Status of the following programs are reported: nondestructive assay; development and demonstration of Dynamic Materials Control-DYMAC Program; and perimeter safeguards and material verification. (LK)

6083 (LA—6849-PR) **Nuclear safeguards research and development program. Status report, January—April 1977.** Sapir, J.L. (comp.). (Los Alamos Scientific Lab., N.Mex. (USA)). Jun 1977. Contract W-7405-ENG-26. 60p. Dep. NTIS, PC A04/MF A01.

The status of the Nuclear Safeguards Research and Development program pursued by LASL Safeguards Groups Q-1, Q-2, Q-3, and Q-4 is presented . Topics covered include nondestructive assay technology development and applications, international safeguards, perimeter safeguards and surveillance, concepts and subsystems development (e.g., DYMAC program), integrated safeguards systems, training courses, and technology transfer.

6084 (LA-UR—2247) **Nondestructive assay instruments for the DYMAC program at the Los Alamos Scientific Laboratory.** Marshall, R.S. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 9p. (CONF-771031—3). Dep. NTIS, PC A02/MF A01.

From 21. conference on analytical chemistry in energy technology; Gatlinburg, Tennessee, USA (4 Oct 1977).

A real-time, nuclear materials control system, called DYMAC, will begin operation in November at the new plutonium processing facility at the Los Alamos Scientific Laboratory. The DYMAC system relies on three types of nondestructive assay instruments to control nuclear material dynamically: weighing instruments, neutron counters, and gamma counters. Remoted electronic balances and load cells weigh the nuclear material in process. DYMAC uses two types of neutron counters, thermal-neutron coincidence counters and fast-neutron coincidence counters. There are two types of gamma counters, one assays liquids and another solids; both are gamma spectroscopy instruments which use germanium detectors.

6085 (NP—22652) **Hearings on nuclear safeguards, proliferation, and alternate fuel cycles.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). 17 Jun 1977. 251p. Energy Resource Conservation and Development Commission, Sacramento, CA.

Witness testimony was presented on Arms Control and Disarmament Agency overview on proliferation implications of alternate fuel cycles, nonproliferation alternatives, non-proliferation and safeguards improvements in fuel cycles, vulnerability of nuclear fuel cycles to malevolence, and status of Federal schedules and plans in the back end of the fuel cycle. (LK)

6086 (NUREG—0317(Vol.1)) **VISA: a method for evaluating the performance of integrated safeguards systems at nuclear facilities.** Donnelly, H.; Fullwood, R.; Glancy, J. (Science Applications, Inc., La Jolla, Calif. (USA)). Jun 1977. 122p. NTIS $6.00.

VISA - vulnerability of integrated safeguards analysis - is described and discussed. Important features of this evaluation method are given. (LK)

6087 (NUREG—0317(Vol.2)) **VISA: a method for evaluating the performance of integrated safeguards systems at nuclear facilities.** Donnelly, H.; Fullwood, R.; Glancy, J. (Science Applications, Inc., La Jolla, Calif. (USA)). Jun 1977. vp. NTIS $6.00.

This is the second volume of a two volume report on the VISA method for evaluating safeguards at fixed-site facilities. This volume contains appendices that support the description of the VISA concept and the initial working version of the method, VISA-1, presented in Volume I. The information is separated into four appendices, each describing details of one of the four analysis modules that comprise the analysis sections of the method. The first appendix discusses Path Analysis methodology, applies it to a Model Fuel Facility, and describes the computer codes that are being used. Introductory material on Path Analysis given in Chapter 3.2.1 and Chapter 4.2.1 of Volume I. The second appendix deals with Detection Analysis, specifically the schemes used in VISA-1 for classifying adversaries and the methods proposed for evaluating individual detection mechanisms in order to build the data base required for detection analysis. Examples of evaluations on identity-access systems, SNM portal monitors, and intrusion devices are provided. The third appendix describes the Containment Analysis overt-segment path ranking, the Monte Carlo engagement model, the network simulation code, the delay mechanism data base, and the results of a sensitivity analysis. The last appendix presents general equations used in Interruption Analysis for combining covert-overt segments and compares them with equations given in Volume I, Chapter 3.

6088 (SAND—77-0517) **Environmental data processor of the adaptive intrusion data system.** Rogers, M.S. (Sandia Labs., Albuquerque, N.Mex. (USA)). Jun 1977. Contract EY-76-C-04-0789. 24p. Dep. NTIS, PC A02/MF A01.

A data acquisition system oriented specifically toward collection and processing of various meteorological and environmental parameters has been designed around a National Semiconductor IMP-16 microprocessor, This system, called the Environmental Data Processor (EDP), was developed specifically for use with the Adaptive Intrusion Data System (AIDS) in a perimeter intrusion alarm evaluation, although its design is sufficiently general to permit use

elsewhere. This report describes in general detail the design of the EDP and its interaction with other AIDS components.

6089 (SAND—77-0605) **Bilevel alarm monitoring multiplexer.** Johnson, C.S. (Sandia Labs., Albuquerque, N.Mex. (USA)). Jun 1977. Contract EY-76-C-04-0789. 13p. Dep. NTIS, PC A02/MF A01.

This report describes the operation of the Bilevel Alarm Monitoring Multiplexer used in the Adaptive Intrusion Data System (AIDS) to transfer and control alarm signals being sent to the Nova 2 computer, the Memory Controlled Data Processor, and its own integral Display Panel. The multiplexer can handle 48 alarm channels and format the alarms into binary formats compatible with the destination of the alarm data.

6090 (SAND—77-1040C) **Automated approach to nuclear facility safeguards effectiveness evaluation.** (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 4p. (CONF-771109—20). Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, California, USA (27 Nov 1977).

Concern over the security of nuclear facilities has generated a need for a reliable, time efficient, and easily applied method of evaluating the effectiveness of safeguards systems. Such an evaluation technique could be used (1) by the Nuclear Regulatory Commission to evaluate a licensee's proposal, (2) to assess the security status of a system, or (3) to design and/or upgrade nuclear facilities. The technique should be capable of starting with basic information, such as the facility layout and performance parameters for physical protection components, and analyzing that information so that a reliable overall facility evaluation is obtained. Responding to this expressed need, an automated approach to facility safeguards effectiveness evaluation has been developed. This procedure consists of a collection of functional modules for facility characterization, critical path generation, and path evaluation combined into a continuous stream of operations. The technique has been implemented on an interactive computer-timesharing system and makes use of computer graphics for the handling and presentation of information. Using this technique a thorough facility evaluation can be made by systematically varying parameters that characterize the physical protection components of a facility according to changes in perceived adversary attributes and strategy, environmental conditions, and site status.

6091 (SAND—77-1165) **KSPTH: a subroutine for the K shortest paths in a sabotage graph.** Hulme, B.L.; Holdridge, D.B. (Sandia Labs., Albuquerque, N.Mex. (USA)). Aug 1977. Contract EY-76-C-04-0789. 27p. Dep. NTIS, PC A03/MF A01.

Finding shortest paths in a weighted graph model is one way for a safeguards analyst to locate weaknesses in a facility's barrier and alarm system. KSPTH can be used to rank sabotage paths according to path length so that the K shortest paths can be studied by more detailed methods to see which possess additional properties attractive to an adversary. While emphasizing how to use KSPTH, this report explains the K-th shortest path algorithm of Hoffman, Pavley and Dreyfus and contains a sample problem test results and program listings.

6092 **Safeguards against nuclear proliferation.** Cambridge, MA; MIT Press (1975). 121p. .

An overview of the International Atomic Energy safeguards, something of their history, their applications, and suggestions for further development are presented. The safeguards discussed include both those that are applied under the Treaty on the Non-Proliferation of Nuclear Weapons and those which countries have accepted under other agreements. The material presented is divided into 5 chapters entitled: The Background; Some Basic Issues; The Application; Funds and Figures; and Further Developments. Related materials are included in 7 separate appendices. (BLM)

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 7438

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

ISOTOPIC POWER SUPPLIES

6093 (BNWL—2266) **Cost analysis for application of solidified waste fission product canisters in U.S. Army steam plants.** Sande, W.E.; Bjorklund, W.J.; Brooks, N.A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1977. Contract EY-76-C-06-1830. 165p. Dep. NTIS, PC A08/MF A01.

The main objectives of the present study are to design steam plants using projected waste fission product canister characteristics, to analyze the overall impact and cost/benefit to the nuclear fuel cycle associated with these plants, and to develop plans for this application if the cost analysis so warrants it. The construction and operation of a steam plant fueled with waste fission product canisters would require the involvement and cooperation of various government agencies and private industry; thus the philosophies of these groups were studied. These philosophies are discussed, followed by a forecast of canister supply, canister characteristics, and strategies for Army canister use. Another section describes the safety and licensing of these steam plants since this affects design and capital costs. The discussion of steam plant design includes boiler concepts, boiler heat transfer, canister temperature distributions, steam plant size, and steam plant operation. Also, canister transportation is discussed since this influences operating costs. Details of economics of Army steam plants are provided including steam plant capital costs, operating costs, fuel reprocessor savings due to Army canister storage, and overall economics. Recommendations are made in the final section.

6094 (COO—3043-29) **Artificial heart develpment program. Phase III. Quarterly progress report, April 1, 1977—June 30, 1977.** (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Advanced Energy Systems Div.). 1977. Contract EY-76-C-02-3043. 35p. Dep. NTIS, PC A03/MF A01.

Technical progress and accomplishments on the active program tasks for the period from April 1, 1977 through June 30, 1977 are reported. The tasks include: (1) Blood Pump Engineering Support; (2) IVBM System Engineering Support; (3) Blood Pump Fabrication and Repair; (4) IVBM System Repair and Support; and (5) Quality Assurance. (TFD)

HYDROGEN

PRODUCTION

REFER ALSO TO CITATION(S) 6119

6095 **Plant for the production of hydrogen through utilization of heat energy obtained from a gas-cooled nuclear reactor.** Baumgaertner, H.; Barchewitz, E. (to Hochtemperatur-Reactorbau GmbH). US Patent 4,045,285. 30 Aug 1977. Priority date 23 Nov 1974, German, Federal Republic of (F.R. Germany). 10p.

Disclosed is a plant for the production of hydrogen, preferably for the hydrogenating gasification of coal, through utilization of heat energy derived from a gas-cooled, high-temperature nuclear reactor comprising: (a) a thick-walled pressure vessel; (b) a high temperature reactor contained in a centrally oriented cavity within the vessel; (c) a plurality of process gas cracking reactors contained within the wall of the vessel; (d) a number of steam generators corresponding to the number of the gas cracking reactors, the generators being contained in the wall of the vessel; (e) a number of recuperative heat exchangers corresponding to the number of gas cracking reactors, each of the heat exchangers being contained in the wall of the vessel and being positioned closely adjacent one of the gas cracking reactors; and (f) a coaxial conduit connecting said adjacent heat exchanger and gas cracking reactor pairs.

6096 **Solar production of hydrogen as a means of storing solar energy.** Veziroglu, T.N.; Kakac, S. (Univ. of Miami, Coral Gables, FL). pp 399-417 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Solar energy must be stored for use when it is not available, and it must be made transportable from the regions where it is abundant to the centers of energy consumption. Converting solar energy to hydrogen for storing and transporting energy looks an attractive solution. The paper considers various methods of producing hydrogen using solar energy and compares them.

6097 **Solar energy utilization: the photochemical approach.** Broda, E. (Univ. of Vienna). pp 471-480 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The essential feature of bacterial and plant photosynthesis is the light-powered transfer of an electron to a compound with a standard redox potential about equal to that of hydrogen in neutral

solution. A hypothesis is put forward on how photolysis evolved in the history of organisms. Theoretically, it is possible to photolyse water into hydrogen and oxygen without participation of organisms, or even biogenic substances. This necessitates the application of the membrane principle where hydrogen and oxygen are set free in different loci. Hydrogen could be used as a basis for a technical hydrogen economy.

ELECTROLYSIS

REFER ALSO TO CITATION(S) 6104

6098 (FE—2262-11) **Hydrogen generation process. Quarterly technical progress report, November 17, 1976—February 16, 1977.** Koump, V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Advanced Energy Systems Div.). Mar 1977. Contract EX-76-C-01-2262. 77p. Dep. NTIS, PC A05/MF A01.

The objective of this program is to assess the technical and economic feasibility of a hybrid electrolytic-thermochemical hydrogen generation process based upon the electrolysis of sulfurous acid. To do this, a multi-task program is being carried out to experimentally determine the operating characteristics of key process steps in the hydrogen generating cycle and to perform engineering and economic analyses to evaluate the system. During the second quarter considerable progress was made in the overall program. In the electrolysis area, measurements of permeabilities and electrical resistivities of microporous rubber membranes continued for a range of operating conditions. Continued effort on the briquetted carbon electrode has shown improved performance and led to a decision to use this electrode type for both the cathode and anode in the cell demonstration. Tests on different configurations of platinum catalysts for sulfur trioxide reduction have shown that spherical pellets, with the catalyst deposited primarily on the surface, appear to use the catalyst more effectively than cylindrical pellets or spherical pellets with catalyst uniformly distributed throughout the mass of the sphere. Exposure of gold and platinum containment capsules to sulfuric acid at 642°F accumulated 2200 hr with no evidence of attack. Mass and energy balances for revised flow sheets have been completed, indicating overall efficiencies of more than 50% for all of the alternate cases considered.

6099 **Theory of hydrogen production in a photoelectrochemical cell.** Bockris, J.O'M.; Uosaki, K. (Flinders Univ., Bedford Park, Australia). pp 435-470 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A qualitative model is set up for the calculation of the relations between rate of photon impact on an electrode and the number of successful transitions of resultant electrons to form hydrogen. The theory is applied to semiconductors. The dependence of the photo-current upon a number of parameters is derived. The theoretical results are used to estimate the actual performance of cells which would evolve hydrogen and oxygen under the influence of light. The calculated efficiencies vary from about 0.1 to 30%. The ideal semiconductor in this type of direct photo-producer of hydrogen is discussed.

6100 **Energy considerations in HHE power systems.** Scott, R.E. (Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia). pp 777-784 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A helioelectrolytic scheme is examined which is similar to a heliohydroelectric system. A hole is dug into the earth and water is allowed to fall into it. At the bottom the water is collected and electrolyzed to hydrogen and oxygen. These gases escape to the surface of the earth via a second hole. Energy is abstracted from the water as it falls by means of conventional turbines. The gases are also available at the surface for recombination and energy release. The energy relationships of this system are examined and compared with the conventional heliohydroelectric system.

THERMOCHEMICAL PROCESSES

REFER ALSO TO CITATION(S) 6098

6101 (LA-UR—77-2030) **Carbonation of cerium oxychloride.** Peterson, E.J.; Onstott, E.I.; Bowman, M.G. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 7p. (CONF-771039—1). Dep. NTIS, PC A02/MF A01.

From 13. rare earth research conference; Olgebay Park, West Virginia, USA (16 Oct 1977).

Cerous carbonates can be used in thermochemical cycles for H production if the resulting ceric oxides can be converted back into cerous carbonates. One way is to reduce and hydrolyze ceric oxide with HCl to produce CeOCl and then to carbonate it. The reaction $3CeOCl + 3CO_2 + 8H_2O \rightarrow CeCl_3(aq) + Ce_2(CO_3)_3 \cdot 8H_2O$ was found to occur in aqueous medium if the final $CeCl_3$ content is low. Carbonation of CeOCl could also be conducted in acetone $-H_2O$. $CeClCO_3 \cdot 3H_2O$ was decomposed and characterized. The reactions which can be used for water splitting are discussed briefly. (DLC)

6102 **Hydrogen production by thermochemical reactions.** Hofmann, H. (Univ., Erlangen-Nuernberg, Ger.). *Int. Chem. Eng.;* **17**: No. 3, 409-413(Jul 1977).

Translated from Chem.-Ing.-Tech.; 48: No. 2, 87-91(1976).

Discussion of new types of energy carriers has recently intensified. One possible alternative to existing systems is the use of hydrogen generated by thermal splitting of water by available nuclear or solar energy. In order that this splitting may be carried out at temperatures below 1000°C a number of cyclic processes have been proposed based on the ease with which metal halides, for example, change valence. The chemistry, thermodynamics, and kinetics of the most developed of these thermochemical cycles are reviewed and the difficulties in their technical realization are pointed out.

6103 **Thermo-chemical production of hydrogen.** Sayigh, A.M.; Sabbagh, J.A.; Abdul-Salam, E.; Abdul-Azeem, E.M. (Univ. of Riyadh, Saudi Arabia). pp 429-434 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Production of hydrogen by closed-cycle thermochemical cracking of water, using compounds of iron, zinc, and bromine, as intermediate materials, is proposed. The maximum operating temperature is expected to be less than 500°C. The quantity of heat required was estimated from enthalpy of formation of reactants and products. It is proposed to harness solar radiation for this process.

BIOSYNTHESIS

6104 **Hydrogen and electricity from water and light.** Ohashi, K.; McCann, J.; Bockris, J.O'M. (Flinders Univ. of South Australia, Bedford Park). *Int. J. Energy Res.;* **1**: No. 2, 259-277(1977).

Four self-driven photoelectrochemical hydrogen producers, stable gallium phosphide and cadmium telluride photocathodes and various combinations with two photoanodes, titanium dioxide and strontium titanate, were constructed and examined in one-molar sodium hydroxide. The current potential curves of the individual electrodes and the current-cell voltage relationships were measured. Cell current-density measurements versus time demonstrated that the output of each cell is stable for at least 12 hours. The strontium titanate/gallium phosphide cell under xenon light irradiation was the most efficient at 0.7 percent. The titanium dioxide/gallium phosphide cell was estimated as the most efficient under solar light at 0.1 percent. The stability of cadmium telluride and its energy gap of 1.5 electron volts make it a prospect for use as a photocathode in future photoelectrochemical hydrogen producers. 12 references.

6105 **Photosynthetic production of hydrogen.** Neil, G.; Nicholas, D.J.D.; Bockris, J.O'M.; McCann, J.F. (Flinders Univ., Bedford Park, Australia). pp 481-487 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The hydrogen producing capabilities of Anabaena Cylindrica, a blue-green algae, are examined. The experimental set up is described and results showing hydrogen and ethylene evolution with time are presented for several solutions. It is estimated that to produce hydrogen from solar energy to power a city of one million people at a rate of 10 kW per person, an area of about 400 km^2 would be needed. However, many problems still need to be solved before producing hydrogen on a large scale via biological systems becomes feasible.

6106 **Selectivity in photochlorination using solar energy.** Parchamazad, I.; Guillemonat, A. (Tehran Univ., Iran). pp 488-491 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Results are presented of experiments on the effect of light intensity on the production of chain-chlorinated isomers of n.p.B.

PARTIAL OXIDATION PROCESSES

6107 Process for the production of gaseous mixtures. Callcott, T.G.; Deague, T.K. (to Broken Hill Proprietary Co. Ltd.). US Patent 4,042,344. 16 Aug 1977. Priority date 9 May 1975, Australia. 10p.

A process for the production of a gaseous mixture containing substantial amounts of carbon monoxide and hydrogen, which comprises: (1) blending an oxidizing gas and a primary fuel within a combustion chamber having a combustion zone, which is substantially free of baffles, to produce a compressible gas or gas-like mixture; (2) causing the mixture to assume a highly turbulent compact and self-contained configuration by subjecting it to swirl, the swirling mixture having a swirl number greater than 0.5 and no greater than 1.5, and igniting the mixture when in this configuration to achieve total combustion of the primary fuel to produce hot gaseous products; and (3) thereafter mixing and reacting the hot gaseous products with a gas-like secondary fuel in the combustion chamber, wherein the secondary fuel is introduced into the combustion chamber adjacent to the wall thereof and in physical contact with the self-contained configuration, to produce a gaseous mixture containing substantial amounts of carbon monoxide and hydrogen.

STORAGE

6108 On the storage of solhydrogen. Abdel-Aal, H.K.; Nazmy, M.Y. (Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia). pp 418-428 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Different methods of storing hydrogen produced by solar energy are discussed. The most promising are: liquid hydrogen for overseas transportation; liquid ammonia which has to be cracked to give H_2 back; or absorbed hydrogen in metal hydrides such as magnesium or iron-titanium hydride. In general, metal hydrides can be decomposed releasing their hydrogen, while the metal can be used once more in a closed cycle. The availability of metals such as magnesium if recovered economically from sea water, can reinforce the potential of metal-hydrides for storing hydrogen.

CHEMISORPTION

REFER ALSO TO CITATION(S) 6821, 7098

6109 (BNL—23047) **Synthesis and properties of useful metal hydrides. A review of recent work at Brookhaven National Laboratory.** Reilly, J.J. (Brookhaven National Lab., Upton, N.Y. (USA)). Aug 1977. Contract EY-76-C-02-0016. 32p. (CONF-770823—3). Dep. NTIS, PC A03/MF A01.

From International symposium on hydrides for energy storage; Geilo, Norway (14 Aug 1977).

The following alloy systems are of interest for hydrogen storage: Mg-Cu, Mg-Ni, Fe-Ti, and Ti-Cu. Properties of the corresponding hydrides are reviewed. (LK)

INDUSTRIAL AND COMMERCIAL USE

REFER ALSO TO CITATION(S) 7076

OTHER SYNTHETIC AND NATURAL FUELS

PROPERTIES

REFER ALSO TO CITATION(S) 7187

6110 Separation method of methane from other hydrocarbons than methane. Saitoh, O.; Imaki, M.; Asami, H. (to Horiba, Ltd.). US Patent 4,042,332. 16 Aug 1977. Priority date 23 Dec 1974, Japan. 6p.

A method is claimed for the separation of methane from a gaseous mixture containing methane and at least one of ethane and propane which comprises (a) simultaneously passing said gaseous mixture and oxygen over a catalyst comprising platinum on an active carbon carrier; (b) selectively oxidizing the ethane and propane in said gaseous mixture at a temperature of about 170°C and (c) recovering methane from said mixture.

6111 Preliminary study of smoke formed in the combustion of various jet fuels. Dodds, W.J. (Purdue Univ., Lafayette, IN); Peters, J.E.; Colket, M.B. III; Mellor, A.M. *J. Energy;* **1**: No. 2, 115-120(1977).

A simplified, disk-stabilized combustor has been used to study particulate sampling methodology and fuel effects on combustion zone particulate concentration. These samples were extracted via filtration with subsequent gravimetric analysis at six axial positions ranging from 3.8 to 29.2 cm from the fuel injector. Sampling techniques, including the effects of sample temperature, particle deposition, sample drying, and sampling rate, have been evaluated. Measurement guidelines are proposed. Five fuels—petroleum-based Jet A, low-aromatic Jet A, Jet A blended with 15 percent rubelene, petroleum based JP-4, and JP-5 refined from an oil shale derived syncrude—were investigated. Axial concentration profiles suggest a particulate emission dependence on fuel hydrogen (or aromatic) content as well as volatility. Measured primary zone particulate concentrations were two orders of magnitude greater than exhaust values.

PREPARATION

CHEMICAL SYNTHESIS

6112 (FE—2203-17) **Investigation of converting the products of coal gasification to methane by the action of microorganisms: Phase I. Final report, November 1, 1975—December 1, 1976.** Augenstein, D.C.; Wise, D.L.; Wentworth, R.L.; Galliher, P.M.; Lipp, D.C. (Dynatech R/D Co., Cambridge, Mass. (USA)). 7 Jan 1977. Contract EX-76-C-01-2203. 142p. Dep. NTIS, PC A07/MF A01.

Substantial progress on the present program has demonstrated the practicality of using anaerobic fermentation to convert coal gasifier product gases to methane. A significant accomplishment of this program was to attain methane productivities as high as 224 volumes CH_4 per volume of reactor per day (VVD). Although this productivity of the biological system is lower than productivities of chemical catalytic processes which are over 1000 hr^{-1}, a preliminary analysis indicates that biomethanation can compare favorably with catalytic processes in terms of the important parameter of methane productivity per dollar of capital cost in the methanation section. Continuous fermenter operation at pressures as high as 450 psig has been carried out for extended periods of time, i.e., over three months continuous operation. Moreover, hydrogen sulfide levels in the feed gases, as high as 6% H_2S, have been shown to provide a suitable sulfur source for microorganism growth. Continuous bioconversion of CO has now been demonstrated. Operation at thermophilic conditions of up to 66°C was carried out in addition to mesophilic operation at 37°C. A process design was developed showing the application of this biomethanation technology to a coal gasifier. A preliminary economic analysis was also performed following the work of Katell. Biomethanation was found to be competitive with catalytic methanation on a purchased capital equipment basis at approximately 250 VVD.

6113 (FE—2276-14) **Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Monthly report for August 1977.** (Mobil Research and Development Corp., Paulsboro, N.J. (USA); Mobil Research and Development Corp., Princeton, N.J. (USA)). Sep 1977. Contract EX-76-C-01-2276. 52p. Dep. NTIS, PC A04/MF A01.

Micro reactor studies with developmental catalyst SG-B-3 show that pressures greater than 100 psig are necessary for high C_5^+ gasoline selectivity. Multiple air regenerations (greater than 2) of catalyst SG-B-3 at 950°F for 16 hr are detrimental to catalyst life. Catalyst SG-A-3, the fixed bed version of developmental fluid catalyst SGF-A-2, showed very little aging during 20 days operation in a micro reactor. Regeneration studies of SG-A-3 have been initiated. Preliminary data indicate that SG-A-3 is not regenerable in hydrogen. Fluid bed operation using catalyst SGF-B-1 in the bench-scale unit have continued. In situ air regeneration at 850°F for two hours follow by an activation for 10 hr at 750°F in hydrogen was previously shown to be successful. Recent findings indicate that long times or high temperature (950°F) or regeneration under pressure are harmful with respect to catalyst life. Heat loss calculations for the fixed and fluid bench-scale units show that both performed very close to design specification with respect to control of reactor temperatures. Target product selectivities and properties from Mobil's Direct Conversion Process have been provided to ERDA Contract EF-76-C-01-2447 for use in a sensitivity study in their comparison of Mobil's Methanol to Gasoline with Conventional Fischer-Tropsch. A survey of various coal gasifiers has been made in order to define synthesis gas compositions available for conversion to gasoline.

6114 Process and apparatus for converting hydrocarbon gases. Youker, M.P. (to Phillips Petroleum Co.). US Patent 1,976,469. 9 Oct 1934. Filed date 23 Feb 1933. vp.

A process is described for converting normally gaseous hydrocarbons to normally liquid hydrocarbons. The gaseous hydrocarbons are passed in liquid condition in a restricted stream through a heating zone, wherein they are heated to temperatures of from 750 to 1250°F under pressures of from 500 to 3500 pounds per square inch. The pressure on the products is reduced by the temperature and pressure conditions. The products are passed into a first rectifying zone maintained under superatmospheric pressure but at pressures below that existing in the heating zone and rectified to obtain a fraction lighter than gasoline, a gasoline containing fraction, and a fraction heavier than gasoline. The fraction lighter than gasoline is subjected to condensation under the pressure existing in the first rectifying zone. The resulting condensate is mixed with fresh liquefied normally gaseous hydrocarbons, and a portion of the mixture is returned as reflux to the first rectifying zone.

PREPARATION FROM WASTES OR BIOMASS

REFER ALSO TO CITATION(S) 6206, 6207, 6496, 7058

6115 Process for conversion of solid refuse to fuel gas using pelletized refuse feed. Anderson, J.E. (to Union Carbide Corp.). US Patent 4,042,345. 16 Aug 1977. Filed date 12 Apr 1976. 6p.

A process is claimed for simultaneously disposing of refuse and producing a useful fuel or synthesis gas and an inert inorganic residue by feeding shredded refuse, from which ferrous metal has preferably been magnetically separated, and which has been compacted into hard pellets, into an oxygen fed pyrolizing, slagging shaft furnace.

PREPARATION

REFER ALSO TO CITATION(S) 6206, 6207

SOLID WASTE FUELS

REFER ALSO TO CITATION(S) 6212

6116 Process for manufacturing combustible bricks from plant materials. Loas, D. (to Agence Nationale de Valorisation de la Recherche (ANVAR)). US Patent 4,043,764. 23 Aug 1977. Priority date 18 Apr 1975, France. 6p.

Combustible bricks are manufactured from plant materials by agglomeration under pressure of these materials after pulverization and drying. Prior to this, the plant materials are subjected to a fermentation and, in the course of fermentation, to a pulverization treatment while controlling this fermentation so as to obtain a destructuration of the cellulosic tissues of the plant materials without producing separation of the lignin. This process produces small bricks having a good strength and a low moisture content.

HYDRO ENERGY

REFER ALSO TO CITATION(S) 6223

PLANT DESIGN AND OPERATION

REFER ALSO TO CITATION(S) 6816

POWER CONVERSION SYSTEMS

6117 Method of calculation of relative eccentricity of hydraulic turbine stators. Kan, A.V.; Medvinskaya, G.Y. (Leningrad Met Plant, USSR). *Energomashinostroenie;* No. 4, 5-6(1977). (In Russian).

Until recently, in stators of hydraulic turbines, blades were used whose bearing on one another, with a closed stator, was implemented against flat contact surfaces. Leading edges of such blades were made with chamfers and, for them, a method of calculation of relative eccentricity has been worked out. Recently, blades without a chamfer at the leading edge have come into use. A method of calculation of relative eccentricity for such blades is presented.

SOLAR ENERGY

REFER ALSO TO CITATION(S) 6894, 6981, 6982, 6983

6118 (AED-Conf—77-027-005) **Solar energy research in European Communities.** Strub, A. (Commission of the European Communities, Brussels (Belgium)). 1977. 14p. (In German). (CONF-770378—5). Dep. NTIS (US Sales Only), PC A02/MF A01.

From 3. meeting of the Deutsche Gesellschaft fuer Sonnenenergie e.V. on heating with sun 2 - house technology under practical aspects; Munich, F.R. Germany (3 Mar 1977).

The article gives a survey of a four-year program of the Commission of the European Community which covers several plans to improve the utilization of solar energy. The amounts used in the countries of the Community for solar energy research are shown. The following central points are supported from the technical point of view: (1) flat-plate collectors and their use in buildings; (2) thermal solar power plants; (3) photoelectric conversion; (4) photochemical and photobiological processes; (5) bioconversion, and (6) collection of data on solar radiation. Finally, organization and management of the EC solar research program are reported.

6119 Principles and ways to utilize sun energy. Reinhard, K. (ERNO Raumfahrttech, Bremen, Ger). *Klima Kaelte Ing.;* **5**: No. 4, 147-158(Apr 1977). (In German).

After an introductory review of the energy source "sun" and sun radiation toward the earth, design, efficiency, performance layout charts and spheres of utilization of thermal sunray collectors as well as various opportunities of heat storage are shown, partly with the help of diagrams. The areas of utilization within Northern Europe are explained as heating of swimming pools, preparation of domestic hot water, space heating and air conditioning as well as for southern countries the desalination of water, generation of electricity and production of hydrogen. Some completed installations including measurement results are presented. 39 refs.

6120 Formulation of energy policies: the case of West Africa. Soussou, J.E.; Seifert, W.W. (Development Analysis Associates, Inc., Cambridge, MA). pp 609-635 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

With rising energy consumption and costs, balance of trade problems are likely to worsen. Many solar energy applications could be useful to development. However, required capital and time generally exceed the capabilities of single developing countries. A set of models, developed for West Africa, illustrates the role of modeling in the formulation of long-term energy policies. These models yield energy demand projections and costs associated with alternative energy policies over the period 1970 to 2000. They focus on the trade-offs entailed in the high initial costs of developing local resources as opposed to importing hydrocarbon fuels.

6121 Solar technology and the developing countries. Kara, K.M.; Tabet-Aoul, M. (Institut Hydrometeorologique de Formation et de Recherches, Oran, Algeria). pp 636-640 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The promotion of solar technology in a developing country proceeds by taking into consideration three essential factors which are: the pressure of the proprietary needs of the country in the base sectors of the economy such as agriculture, industry, energy, environmental protection, and evaluation of arid and semi-arid zones; the degree of sensitivity of the national authorities to the consideration of the economic role of solar technology; and the setting up of appropriate structures and organization for solar technology in the country and ways of organizing a professional corps with all categories.

6122 Role of solar energy in the developing countries: prospects in Mali. Traore, C. (Laboratoire de l'Energie Solaire, Bamako, Mali). pp 641-658 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper describes the studies made or underway in the Laboratoire National de l'Energie Solair of Mali. These projects include water heaters, stills, drying apparatus, solar stoves, and solar pumps as well as studies on climatization and activities for the

popularization of solar processes. These projects illustrate the role and the importance that this energy can play in the group of developing countries.

6123 **Solar energy research in Iran.** Dabiri, A.E. (Arya-Mehr Univ., Tehran, Iran). pp 659-664 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper presents the current status of solar energy research and development in Iran as well as the programs envisaged for the future. The following major areas are being pursued: (1) thermal processes for domestic applications including development of flat plate and concentrating collectors, solar water heating, space heating and air conditioning systems; (2) solar cells development for use as the prime energy source in remote telecommunication transmission stations; and (3) water desalination and hydrogen production with solar energy.

6124 **Research at the EURATOM-CCR center.** Gretz, J. (EURATOM-CCR, Ispra, Italy). pp 665-669 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper summarizes briefly the work done at CCR-Ispra on solar energy research. This work concentrates mainly on collector development including use of selective surfaces and concentration, semiconductor/electrolyte cells, and biochemical conversion of sunlight.

6125 **Exploitation of solar energy in Greece.** Hatzikakidis, A.D. (COMPLES, Athens). pp 670-673 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This is a short review of solar energy activities in Greece since the mid-fifties.

6126 **Solar energy projects in Spain.** De Azcarraga, L. (Comision Nacional de Energias Especiales, Madrid). pp 674-680 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper discusses the role of solar energy research in the Spanish national energy program. Solar energy could provide 5 percent of Spain's energy need by the end of the century. The projects carried out by several institutions include solar thermal conversion, air-conditioning, water heating, and photovoltaic conversion.

6127 **Solar energy in Switzerland.** Mueller, R.E. (Office Federal de l'Economie Energetique, Berne). pp 681-695 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper describes the research and development efforts in the area of heat production by solar energy undertaken on both the government level and on the private enterprise level. The most recent Swiss projects on the production of mechanical or electrical energy are also included.

6128 **National Science Foundation (U.S.A.) Solar Energy Program.** Mukherjee, T. (National Science Foundation, Washington, DC). pp 696-701 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The main objectives and major accomplishments of the United States solar energy program initiated under the federal leadership of the National Science Foundation is reviewed. The overview includes a brief historical background, approach and program organization. Six terrestrial application areas of solar energy are addressed in the national program: (1) heating and cooling of buildings; (2) solar thermal energy conversion; (3) wind energy conversion; (4) ocean thermal energy conversion; (5) photovoltaic energy conversion, and (6) bioconversion to fuels. The new research and applications projects are addressed to innovative technologies and systems having high risk, but high potential payoff.

6129 **New energies: solar energy.** Paris; Service d'Information et de Diffusion (1976). 57p. (In French). (NP—21306). .

A brochure is presented whose objective is to disseminate as clearly and simply as possible the present status of information on solar energy. The topics discussed are the characteristics of solar energy and the meteorological factors affecting it, use of solar energy for heating, the solar motor, thermodynamic and photovoltaic methods of producing electricity, biological conversion, photochemistry and solar thermochemistry, and wind energy. (JSR)

RESOURCES AND AVAILABILITY

REFER ALSO TO CITATION(S) 6119, 6984

6130 (SAND—77-8011, pp 13-22) **Mission analysis and insolation data base.** Watson, M.B.; Randall, C.M. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

Mission analysis studied involving computer codes and analytical procedures are described and illustrated. The insolation data base is discussed. Isopleths of average daily direct-normal insolation are shown. The number of cases when the direct-normal insolation remained greater than 0.6 kW/m^2 for four or more contiguous hours are given in similar figures. (MHR)

6131 **Simulator of the apparent course of the sun.** Gaudenzi, P. pp 98-105 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The simulator of the apparent course of the Sun uses a parallel light beam generated from a source of artificial light. The aim is to establish an efficient didactic method. The model will permit the simulation of the apparent course of the Sun for all seasons and hours in a few minutes. It will reproduce daily sunstrokes for all latitudes and for all the days of the year. To take into consideration variations of the density of the atmosphere and other meteorological factors, the intensity of irradiation could be changed by adding filters.

6132 **Survey of quantitative data on the solar energy and its spectral distribution.** Thekaekara, M.P. (Goddard Space Flight Center, Greenbelt, MD). pp 47-72 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A survey is presented of available quantitative data on the total and spectral solar irradiance at ground level and outside the atmosphere. Measurements from research aircraft have resulted in the currently accepted NASA/ASTM standards of the solar constant and zero air mass solar spectral irradiance. The intrinsic variability of solar energy output and programs currently under way for more precise measurements from spacecraft are discussed. Instrumentation for solar measurements and their reference radiation scales are examined. Insolation data available from the records of weather stations are reviewed for their applicability to solar energy conversion. Two alternate methods of solarimetry are briefly discussed.

6133 **Helios solar sonde.** Rau, H. pp 73-76 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The Helios solar sondes program is described. Measurements of these sondes will contribute to the understanding of solar radiation. No data are given.

6134 **Autonomous station for heliometric data acquisition.** Colomes, J.; Lorgeou, M. (Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). pp 77-84 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

In order to know the solar characteristics of sites where solar energy thermodynamic conversion systems can be installed, an automatic and completely autonomous station for solar data acquisition

was constructed. It makes periodic acquisitions and stores the data on magnetic tape for the following areas: (1) pyrheliometry (direct radiation); (2) pyranometry (total radiation; (3) hemispheric pyrradiometry (total radiation + infrared radiation emitted by the sky); (4) ambient temperature. Its characteristics and its operation are described. Because of the "low consumption" concept, it can be left on a site with monthly visits to set the cassette and controls (incorporated test system).

6135 Mathematical model for digital computation of sunshine hours on inclined planes. Coffari, E. (Univ., Rome). pp 106-114 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A simple and accurate mathematical model for the digital computation of the daily hours of direct insolation on a plane of any tilt and orientation is presented.

6136 Computation of solar radiation design curves. Mirza, R.H. (Univ. of Engineering and Tech., Lahore). pp 115-123 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Solar radiation curves are given to help engineers and architects in calculating intensities of solar radiation incident on various surfaces. These values include direct solar radiation on a surface normal to the solar beam and diffuse sky radiation on a horizontal surface. A curve based on American measurements is given for calculating intensity of diffuse sky radiation incident on vertical surfaces. This curve gives due consideration to the non-isotropic distribution of sky radiance. The concept of direct radiation factors in building climatology is briefly discussed.

6137 Distribution of solar radiation in Saudi Arabia. Dogniaux, R. (Institut Royal Meterologique de Belgique, Bruxelles). pp 124-134 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

By application of a predetermination method of solar energy exposures on horizontal and vertical receptor surfaces, tables were calculated giving by decade the variations as a function of the atmospheric clouds and latitude of the total solar radiation reaching a horizontal surface during the course of a day. The tables were calculated on the basis of a calm sky. By use of local microclimatic factors, a distribution map of the total annual radiation in Saudi Arabia was established from these tables. Because of the fragmentary information available, this map should be updated with more complete data.

6138 Evaluation of the hourly distribution of solar radiation from daily values at Baghdad. Abbas, M.A. (Univ. of Baghdad, Iraq); Elnesr, M.K. pp 135-144 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The fraction of direct solar radiation received on a unit horizontal surface at ground level has been treated theoretically and presented graphically as a function of the possible hours of sunshine duration, in such a way that the hourly values of solar radiation could be evaluated for any locality and at any time of the year, if the corresponding daily totals are known. The study was based on the assumption that the atmospheric transmission is constant throughout the day. This assumption is verified experimentally on the basis of long-term average measurements undertaken at Baghdad.

6139 Solar intensity distribution in Spain. Tinaut, D.; Ramos, F. (Patronato de Investigacion, Cientifica y Technica "Juan de la Cierva" C.S.I.C., Madrid). pp 145-151 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Solar Radiation Intensity values correlated with climatological data have been calculated across Spain. The Reddy relation is used in places where experimental values allow validity checks. A modification of the seasonal factors improved the results. The results are presented by mapping the solar intensity distribution.

ECONOMICS

REFER ALSO TO CITATION(S) 6260, 6280

6140 (SAND—76-9225) **Solar total energy lectures.** (Sandia Labs., Albuquerque, N.Mex. (USA)). 1976. Contract EY-76-C-04-0789. 61p. Dep. NTIS, PC A04/MF A01.

The lectures presented describe some of the calculations and experiments under way in the U. S. to determine the feasibility of various types of solar systems. Economic studies continue to say systems are not economical. Other studies reveal a series of tax policies and incentives which favor consumption of fuels over capital investments in any form of capital intensive fuel substitutes. The true cost after taxes of fuels is the most powerful leverage to make solar power either economical or noneconomical.

ENVIRONMENTAL, LEGAL, AND INSTITUTIONAL ASPECTS

REFER ALSO TO CITATION(S) 6261, 6274, 6328

6141 (DSE/2528—1) **Legal barriers to solar heating and cooling of buildings.** Miller, A.S.; Thompson, G.P. (Environmental Law Inst., Washington, D.C. (USA)). Mar 1977. Contract EX-76-C-01-2528. 227p. Dep. NTIS, PC A11/MF A01.

Ways solar energy will probably be used and legal problems its would-be users may encounter are considered. The barriers are reviewed under the following subjects: solar access and land-use issues; building codes; home financing; utilities; mandatory installation; ERDA patent policy; antitrust and fostering competition; labor union resistance and conflicts; property taxes; mobile homes; and tort liability, insurance, and warranties. A bibliography is included. (MHR)

6142 (ORNL/ICES—2) **Safety aspects of small solar installations. A bibliography.** James, A.H. Jr. (Oak Ridge National Lab., Tenn. (USA)). 14 Sep 1977. Contract W-7405-ENG-26. 16p. Dep. NTIS, PC A02/MF A01.

Solar energy is viewed by many as a very economical alternative to fossil fuel and/or nuclear energy, and considerable developmental work has been undertaken aimed toward harnessing solar energy for heating and air conditioning of buildings, especially residences. However, little attention has been paid to the safety and environmental aspects of solar installations. Some of the health, safety, and environmental hazards which have been identified as being inherent in small solar heating and cooling systems are summerized. The bibliography lists 24 documents that deal with the installation of small solar-heating and air-conditioniong systems, especially for single-family residences.

6143 (SAND—76-8022) **Eye hazard and glint evaluation for the 5-MW/sub t/ Solar Thermal Test Facility.** Brumleve, T.D. (Sandia Labs., Albuquerque, N.Mex. (USA)). May 1977. Contract EY-76-C-04-0789. 64p. Dep. NTIS, PC A04/MF A01.

Potential eye hazards associated with concentrated reflected light are evaluated for the ERDA 5-MW/sub t/ Solar Thermal Test Facility to be constructed at Sandia Laboratories, Albuquerque, New Mexico. Light intensities and hazardous ranges of single and multiple coincident heliostat beams are evaluated at ground level and in the air space above the facility. Possible long-range and short-range effects of distractive effects of reflected beams are discussed. Also described are certain beam control modifications which were incorporated to minimize the altitudes at which overflying aircraft could encounter unsafe levels. Recommendations are made for further evaluation of intensity excursions during fail-safe shutdown situations, and for experiments to verify analytical models and to assess distractive glint effects.

SOLAR ENERGY CONVERSION

REFER ALSO TO CITATION(S) 6096, 6097, 6099, 6100, 6103, 6105, 6106, 6108, 6129, 6519, 6816

6144 (IIASA-RM—77-20) **Solar energy task progress report for 1975/76: evaluation of solar energy options.** Bell, C.R. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). May 1977. 42p. Dep. NTIS (US Sales Only), PC A03/MF A01.

Solar options are evaluated as a potential source for meeting future energy-supply requirements. Emphasis is on contemporary concepts in the solar-thermal and photovoltaic systems and their space, as well as economic constraints. The range of uncertainties during this formative stage of solar technology is shown in typical examples of performance and cost estimates. The broad spectrum of

assessed information is synthesized and condensed for general information as an interim report. The fundamental trends of the continuing efforts in the subject field are identified.

6145 (IIASA-RM—77-23) **Systems aspects of large-scale solar energy conversion.** Weingart, J.M. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). May 1977. 36p. (CONF-761246—1). Dep. NTIS (US Sales Only), PC A03/MF A01.

From Systems aspects of large-scale solar energy conversion; Versailles, France (13 Dec 1976).

With a view to the potential role of solar energy as a global energy option, the presently known solar energy technologies are employed to contribute to the world energy supply. Such a global solar energy supple system would evolve in stages of development, proceeding from local use of solar energy to regional and global systems. The initial stage would include local low-temperature applications for heating purposes, and the embedding of small amounts of solar electric generation capacity in the existing electric grids. Regional interconnections of solar electric power generation would be followed by increasing production of solar fuels in locations with favorable insolation, and by long-distance transport of these fuels. It turns out that much more needs to be known about the behavior of very large integrated solar energy conversion systems. Market penetration calculations indicate that it takes roughly five decades for a major source of energy to be developed and used on a truly significant scale. It therefore would be necessary to initiate large-scale deployment of solar energy perhaps 50 years or more before fossil resources are finally depleted.

PHOTOVOLTAIC CONVERSION

6146 (CONF-770318—) **Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.** (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Solar Energy). 1977. 701p. Dep. NTIS, PC A99/MF A01.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

Separate abstracts were prepared for each of the 34 papers included.

6147 (CONF-770318—, pp 1-32) **Status of the silicon technology programs.** Magid, L.M. 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

A brief up-date on the current status of the work within the Silicon Technology Programs Branch of the Photovoltaic Conversion Program is presented. The key elements of this review include: Low Cost Silicon Solar Array Project/JPL; Systems Definition Project/Sandia; Concentration Systems Project/Sandia; Military Applications Project/DoD-MERADCOM; and Tests and Applications Project/NASA-Lewis and MIT Lincoln Labs. The major highlights in each of these areas are summarized in detail.

6148 (CONF-770318—, pp 34-46) **Low cost thin film chemical sprayed CdS—Cu_2S solar cell evaluation.** Samara, G.A. (Sandia Labs., Albuquerque, NM). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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The overall objectives of the Sandia part of this program are to (i) evaluate the process for producing low cost thin film CdS-Cu_2S solar cells using chemical spraying, (ii) provide technical support and analysis capabilities for understanding cell performance and to increase the average cell efficiency, and (iii) help ensure long-term cell stability. Important to the achievement of these objectives is the development of an understanding of the properties of the materials, and characteristics of the cells and spray process. The emphasis during this period has been on (i) determination of factors limiting the cell's performance, (ii) evaluation of additional physical material properties, and (iii) electrical characterization of a selection of the devices. Results to date are described.

6149 (CONF-770318—, pp 47-64) **Development of a thin film polycrystalline solar cell for large scale terrestrial use.** Meakin, J.D. (Univ. of Delaware, Newark). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The research program objectives are: (1) establish analytically and experimentally the conversion efficiency limits for thin film polycrystalline cells based on the CdS/Cu_2S junction; (2) develop the processing technology to give high efficiency cells reproducibly; (3) establish the processes which limit usable cell lifetime; and (4) improve the efficiency of (CdZn)S/Cu_2S cells by achieving the current and fill factor levels achieved with CdS/Cu_2S. Key results to date and planned activities are presented.

6150 (CONF-770318—, pp 65-80) **Reactively sputtered thin film photovoltaic devices.** Hsieh, E.J. (Univ. of California, Livermore). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The project goal is to apply multiple sputtering techniques to form low cost, high performance thin film photovoltaic devices from materials used in existing single and polycrystalline solar cells. The immediate objective is to develop a stable, high efficiency, thin film CdS-Cu_2S cell by reactive sputtering techniques. Progress to date is reported.

6151 (CONF-770318—, pp 81-98) **Research on Cu/sub x/S-(Cd,Zn)S photovoltaic solar energy converters.** Peterson, T.M. (Univ. of California, Livermore). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The primary objective of this program is to obtain a better understanding of the basic mechanisms of operation of the cuprous sulfide/cadmium-zinc sulfide heterojunction solar cell. This will be achieved by (1) studying the growth and physical and electrical properties of epitaxial layers of (Cd,Zn)S; (2) fabricating heterojunction devices on these single-crystal layers; (3) measuring the electrical and photoelectrical properties of these devices at room temperature and below; (4) correlating these device measurements with similar measurements made by others of single-crystal and polycrystal cells of CdS and (Cd,Zn)S to isolate grain boundary effects and clarify operating mechanisms; and (5) developing a physically meaningful, mathematical model capable of predicting Cu/sub x/S/II-VI heterojunction characteristics. Current efforts are described.

6152 (CONF-770318—, pp 99-118) **Improved semiconductors for photovoltaic solar cells.** Rod, R.L. (Monosolar Inc., Santa Monica, CA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

It is planned to develop electroplated solar cells of the types n CdTe/p CdTe; n CdS or n CdSe/p CdTe; n (Cd,Zn) Te or n (Cd,Mg) Te/p CdTe; n CdS or n CdSe/p(Cd,Zn)Te or (Cd,Mg)Te; and n CdTe/p Cu/sub x/Te all with the left side substance on a light-transparent base of glass covered with antimony doped tin dioxide. The work includes manufacture of cells on an experimental basis and measuring their basic properties. Initial work is being concentrated on optimization of an electrochemical method for plating the semiconductor layers. This leads to layer formation at the cathode of a cell with a liquid electrolyte. Efforts to date are summarized.

6153 (CONF-770318—, pp 119-136) **Thin films of silicon on low cost substrates.** 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The objective of this project is to conduct intensive studies of silicon films on low cost substrates in order to produce low cost solar cells of relatively high efficiency and long life. Metallurgical silicon was purified by the treatment of the melt with chlorine followed by unidirectional solidification. The chemical treatment technique is effective for removing aluminum, and unidirectional solidification reduces substantially the concentration of iron and other metallic impurities. Purified metallurgical silicon unidirectionally solidified on graphite was used as substrates for the deposition of solar cells. Large area (30 cm^2) solar cells with an AM1 efficiency of about 7% have been prepared by using the thermal reduction of trichlorosilane containing appropriate dopants for the deposition of the active region of solar cells. The current-voltage characteristics of many epitaxial diodes on various regions of unidirectionally solidified metallurgical silicon have been measured and analyzed on the basis of the two-exponential model. The diode parameters calculated for polycrystalline silicon p-n junctions do not differ appreciably from those for single crystalline silicon solar cells.

6154 (CONF-770318—, pp 137-158) **Energy beam deposition of silicon.** Baghdadi, A.; Gurtler, R.W.; Sarma, K.R.; Cota, M. (Motorola Inc., Phoenix, AZ). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The purpose of this research program is to examine the feasibility of plasma aided chemical vapor deposition technique for rapid and economic production of polycrystalline silicon films of sufficient quality to manufacture 10% or more efficient solar cells. This technique involves RF excitation of the gas molecules which is expected to considerably enhance the overall deposition kinetics. The initial task of the program was to design and construct an Energy Beam deposition chamber and a gas control panel. Two deposition chambers—one made out of stainless steel and the other out of quartz—were designed and constructed. The two deposition chambers are expected to influence the shielding of the RF energy and to some extent the stability of the plasma column differently. Both chambers incorporate features such as electrical feedthroughs, a movable substrate stage, viewing ports, etc. A suitable gas handling system was also designed and constructed. The system allows the carrier gases to be chosen from He, H_2, Ar, or N_2 (or a mixture of these). Similarly the silicon bearing gas could be chosen from SiH_4, $SiHCl_3$, SiH_2Cl_2 or $SiCl_4$. The system also includes helium integrity and an automatic sequencing of the pre-purge, post-purge and failure mode cycles. Progress and results to date are described.

6155 (CONF-770318—, pp 159-176) **Silicon thin film crystallization and solar cell fabrication.** Kirkpatrick, A.R.; Shaughnessy, T.P.; Oren, M. (Simulation Physics, Inc., Bedford, MA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

This program involves tasks and objectives in two technical areas. The first area of investigation involves study of directed energy techniques for recrystallization of silicon thin films. The second area includes development and evaluation of several new processing concepts for thin film solar cell device applications. These processing methods can be applied to thin silicon films from the recrystallization studies of the program but can also have much broader uses for thin films in general. Directed energy sources for recrystallization allow energy to be deposited only into the selected regions being processed. Under this program consideration has been given to Nd:YAG (1.06 μm) and CO_2 (10.6 μm) lasers in continuous and pulse modes and to scanned DC electron beams and extremely short duration pulsed electron beams. Excellent crystallization of amorphous silicon layers on crystalline substrates has been produced by submicrosecond electron beam pulses. Examination of the mechanisms involved suggest that pulsed electron beams may have promise for effective thin film recrystallization. Approaches to thin film device fabrication which are being investigated include the use of temporary substrates for film deposition and partial processing with subsequent film transfer to glass sheets by integral electrostatic bonding. It has been shown to be possible to process both surfaces of a thin film after it has been grown. Techniques have been demonstrated for low temperature fabrication of film junctions by ion implantation in combination with pulsed electron beam anneal. Functioning thin film cells have been fabricated on glass sheets after growth of the films on separate temporary substrates. Cell performance to date has been limited to approximately 1% AMO by quality of the film material but the processing techniques are considered to be developing successfully.

6156 (CONF-770318—, pp 177-192) **Amorphous silicon cells: thin films of silicon on low cost substrates.** Carlson, D.E. (RCA Labs., Princeton, NJ). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

This research program is aimed at the development of a low cost solar cell using discharge produced amorphous silicon (a-Si). The objectives of the program for March 1977 were to develop a 5% efficient a-Si solar cell; to characterize a-Si cells; and to investigate the properties of a-Si. Current efforts and key results are summarized.

6157 (CONF-770318—, pp 193-213) **Silicon schottky photovoltaic diodes for solar energy conversion.** Anderson, W. (Rutgers Univ., Piscataway, NJ). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

Studies continue in an effort to produce a 12% efficient Schottky solar cell on economical silicon. Past reports have shown a V/sub oc/ = 0.58V, which is attributed to a reduced work function for Cr slowly deposited on a thin oxide layer over the silicon. Promising results have been obtained using the Schottky process on Tyco silicon. Auger and environmental tests indicate that the Cu-Cr-oxide-silicon system is stable with heating to 100°C and continued sunlight exposure. Optical constants have been obtained for Cr, Cu, Ag, and SiO for use in computer-aided design of the optical problem. Most recent research has produced a V/sub oc/ = 0.60V on single crystal silicon. A theoretical analysis shows that V/sub oc/ increases with decreased work function, oxide thickness, and surface state density but that an increased neutral level of surface states seems to be beneficial. An etching and oxide growth surface treatment of Tyco ribbon was used to achieve V/sub oc/ = 0.50V and 5.7% efficiency. An oxide treatment of IBM ribbon was used prior to fabricating a 7.3% efficient cell with V/sub oc/ = 0.54V.

6158 (CONF-770318—, pp 214-230) **MIS silicon cells heterostructure single crystal silicon photovoltaic solar cells. Type B: metal heterojunction silicon devices.** Szedon, J.R. (Westinghouse Research and Development Center, Pittsburgh); Fonash, S.J. 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The overall objective for this project is to assess the technical and commercial practicability for power generation of metal heterojunction silicon photovoltaic cells of the metal-insulator-semiconductor (MIS) variety. Three major tasks are being addressed to achieve this objective: (1) fabrication of standard and experimental cells, (2) evaluation of cell performance to theoretical models, and (3) exploration of optimized cell performance. Current efforts and results to date are described.

6159 (CONF-770318—, pp 231-258) **Heterostructure single crystal silicon photovoltaic solar cells (SnO_2/Si).** Ghosh, A.K. (Exxon Research and Engineering Co., Linden, NJ); Feng, T.; Fishman, C.; Merrin, S.; Grater, I. 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The present work can be divided into three parts. The first part involves characterization and analysis of cells previously made by Innotech (Emdex). The second involves degradation studies and the third fabrication of SnO_2/Si devices and problems associated with it. Dark and light I-V curves, C-V measurements, spectral response curves, short circuit vs intensity and, Auger depth profiling studies were done.

6160 (CONF-770318—, pp 259-278) **Heterojunction solar cells.** Anderson, R.L. (Syracuse Univ., NY). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The objective of this research is to investigate the material systems which may be useful for the fabrication of low cost, efficient heterojunction solar cells (HJSC's). The active substrate of principal interest is Si, in both single crystal and polycrystalline form. The window materials include In_2O_3, SnO_2 and alloys of these materials. Particular emphasis is placed on investigating the degradation mechanisms involved in these cells. Previous activities, current activities, key results, and future plans are summarized.

6161 (CONF-770318—, pp 279-301) **Characteristics of OSOS solar cells: oxide semiconductor on silicon heterostructure solar cells.** DuBow, J.B. (Colorado State Univ., Fort Collins). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The objectives of the program have been to fabricate and characterize Indium Tin Oxide (ITO) on single crystal silicon heterostructure solar cells, to model these solar cells analytically, and to estimate the factors which will determine the ultimate economic viability of these types of cells. Results to date are discussed.

6162 (CONF-770318—, pp 302-312) **Modelling of oxide-semiconductor on silicon solar cells.** Shewchun, J. (Brown Univ., Providence). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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In support of the experimental program on Oxide-Semiconductor on Silicon Solar Cells an extensive modelling effort has been conducted. The particular oxide semiconductor being pursued is Indium tin oxide and a considerable effort has been expended in obtaining as much parameter information as possible on this material. This has lead to a number of planned experiments, both in house at other research centers. One of these is a work-function determination. Based on the experimental data, it was chosen to model the OSOS cell as a semiconductor-insulator-semiconductor diode with a thin interfacial (10-20A) layer. This device operates essentially as an MIS diode with the exception that the oxide-semiconductor is a degenerate wide band gap material. Eg is estimated as 3.6 eV at present. Also, the best estimate is that the oxide-semiconductor to insulator barrier height is 3.2 eV. The computer program used for this purpose has been a modified version of the MIS calculational routine which we have described previously in the literature. A real world efficiency of 20% is predicted for the OSOS diode based on actual materials parameters.

6163 (CONF-770318—, pp 313-336) **InP thin film growth on CdS by planar reactive deposition.** Zanio, K.; Fraas, L. (Hughes Research Labs., Malibu, CA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The approach for obtaining a low-cost high efficiency solar cell combines large grain size CdS films obtained by recrystallization with local epitaxy of InP films on these CdS grains. In preparation for the fabrication of this all-thin film solar cell, 1 μm thick InP films were deposited on both single crystal and polycrystalline substrates of CdS by the planar reactive deposition (PRD) technique at temperatures below 400°C. In this technique indium metal is evaporated from a planar source in the presence of P_2 to form InP. A new PRD system containing two evaporative chambers, a residual gas analyzer, and a reflection electron diffraction unit, was constructed. By replacing the previous cells with Knudsen cells, spitting of particulate matter onto the growing films was eliminated. Scanning electron microscope and high energy electron diffraction measurements indicated that complete epitaxy was achieved on single crystal substrates. Since the characteristic lateral dimensions of the grains in recrystallized CdS films are only about 20 μm, quasi-single crystals with aspect ratios of about 20 are expected. This large aspect ratio should eliminate deleterious effects of grain boundary leakage and recombination on cell performance. (In contrast to this approach, present CdS/InP thin film structures are formed by the chemical vapor deposition of InP on an amorphous or small grained polycrystalline substrate. For 1 μm thick InP films, the result is submicron crystals of InP.) Electron mobilities up to 500 cm^2/V sec were obtained for InP epitaxy on [100] semi-insulating GaAs substrates. Mass spectrographic analysis of the InP films established purities in the 1-10 ppma range. The purity of the present films is sufficient so that Be-doping can result in P-type films on the 10^{17}-10^{18} cm^{-3}. All-thin film InP/CdS/ITO on glass structures were fabricated.

6164 (CONF-770318—, pp 337-354) **Thin polycrystalline films of indium phosphide on low-cost substrates.** Manasevit, H.M. (Rockwell International, Anaheim, CA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The 12-month program, which started September 30, 1976, is pursuing the following specific technical objectives: (1) development of the MO-CVD process for growth of good-quality single-crystal or polycrystalline films of InP on carefully-selected low-cost substrate materials; (2) evaluation of the structural, electrical, and optical properties of the resulting InP films; (3) formation of heterojunction device structures by deposition of films of other semiconductors on the InP films, and evaluation of the photovoltaic properties of these composites; and (4) analysis and projection of future costs of large-scale quantities of photovoltaic solar cells made by the process. Current efforts and key results are described.

6165 (CONF-770318—, pp 355-376) **Studies of basic mechanisms influencing solar cell efficiency for terrestrial applications.** Lindholm, F.A.; Sah, C.T.; Fossum, J.G. (Univ. of Florida, Gainesville). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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The purpose of this research is to discover the basic mechanisms controlling solar-cell efficiency and to provide mathematical models that enable the incorporation of these mechanisms into the engineering design of solar cells. The efficiency of a solar cell depends on the electronic parameters that characterize the transport, recombination, and generation of electrons and holes in semiconductors. The research studies aim to develop integrated theoretical and experimental methods for determining the basic mechanisms that control these electronic parameters in solar-cell materials. Progress to date is described.

6166 (CONF-770318—, pp 377-402) **Energy and momentum relaxation of charge carriers in solar cells.** DeFonzo, A.P. (Naval Research Lab., Washington, DC). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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The recombination of charge carriers in solar cells due to energy and momentum relaxation is discussed. Possibilities for the improved characterization of these phenomena are described.

6167 (CONF-770318—, pp 425-450) **Study of II-IV-V_2 chalcopyrite semiconductors for solar cell applications.** Littlejohn, M.A. (North Carolina State Univ., Raleigh); Hauser, J.R.; Benson, R.B.; Schreiner, A.F.; Harrison, J.W.; Andrews, J.E. 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The major objective of this program is the investigation of the growth and material property characteristics of the II-IV-V_2 ternary chalcopyrite semiconductors as a class of materials having promising potential applications for photovoltaic solar cells. The scope of this program includes the construction of a system for vapor phase epitaxial growth of the chalcopyrites on silicon (and other) substrates, along with the complete characterization of the material for solar cell applications. The characterization includes electrical, optical, chemical, mechanical, and structural property measurements. Other important factors bearing on the material applications for terrestrial environments, on means of production and formation, and on engineering and economic considerations are to be investigated.

6168 (CONF-770318—, pp 451-473) **Zn_3P_2 for solar cells improved semiconductors for photovoltaic cells.** Warfield, G. (Univ. of Delaware, Newark). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The overall objective of this project is to evaluate the suitability of Zn_3P_2 as a semiconductor for mass-produced, low-cost, high-efficiency photovoltaic cells for terrestrial use. Materials synthesis has been developed into a routine process. A fair number of small, but usable, single crystals are produced along with the bulk material during the synthesis. Larger crystals are now being grown by a vapor phase Bridgman process. Chemical analysis indicates the starting material is stoichiometric. X-ray analysis shows the Zn_3P_2 structure is stable in the vicinity of the stoichiometric ratio. Thin films have been produced by physical vapor deposition. A set of standard deposition parameters (Source temperature = 750°C and substrate temperature = 220°C) have been identified for the production of well ordered, reproducible films on various substrates.

6169 (CONF-770318—, pp 474-507) **Ternary compound thin film solar cells.** Kazmerski, L.L. (Univ. of Maine, Orono). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The purposes of this program are the investigation of ternary (I-III-VI_2) semiconductor thin films and the utilization of these materials in thin-film photovoltaic devices. The specific objectives include: (1) The continued investigation of ternary thin-film fabrication, emphasizing $CuInS_2$, $CuInSe_2$ and $CuInTe_2$, in order to gain better control over the structural and electrical characteristics of those films; (2) The improvement of the CdS/$CuInSe_2$ thin-film solar cell; (3) The production and improvement of the $CuInS_2$ thin-film homojunction solar cell; (4) The continued testing, using Auger electron spectroscopy (AES) and transmission electron microscopy (TEM), to ascertain the stability and identify the device degradation processes, under appropriate environmental conditions; (5) The production and demonstration of medium (i.e. 5 cm x 5 cm) area

ternary-based devices; and (5) The investigation of other ternary compound thin-film solar cells, including the $CuInSe_2$ - homojunction and $CdS/CuInS_2$ - heterojunction. The activity-to-date is summarized.

6170 (CONF-770318—, pp 508-528) **Improved semiconductors for photovoltaic solar cells: $CuInSe_2$.** Mickelsen, R.A.; Chen, W.S. (Boeing Aerospace Co., Seattle). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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The objective of this 13-month research program is the investigation of $CuInSe_2$ thin films as an inorganic semiconductor material having considerable potential for mass produced, low cost, high efficiency photovoltaic solar cells. $CuInSe_2$ was selected for study because it is one of only four material systems which have demonstrated conversion efficiencies greater than 10% and its properties are consistent with a thin film solar cell array costing less than $300/KW. This particular program is viewed as the first phase of the necessary technical effort leading to the development of these low cost thin film arrays.

6171 (CONF-770318—, pp 529-543) **Sputter-deposited materials for photovoltaic devices.** Pawlewicz, W.T.; Laegreid, N. (Battelle Memorial Inst., Richland, WA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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The long-range objective of this proposed project is the fabrication of low-cost efficient arrays of thin-film solar cells using materials prepared by automated, sequential, high-rate sputter deposition techniques. The materials system chosen for investigation by sputtering is the n-CdS/p-$CuInSe_2$ heterojunction on an ITO-coated glass substrate. This system was chosen because of previous PNL experience with the sputter deposition of CdS and In/sub 1.9/Sn/sub 0.1/O_3 (ITO), which is described. Key results are also discussed.

6172 (CONF-770318—, pp 544-563) **Cuprous oxide photovoltaic cells.** Trivich, D. (Wayne State Univ., Detroit). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The objective is to prepare low cost cuprous oxide photovoltaic cells with good efficiency, using single crystal or coarsely crystalline Cu_2O with junctions to metals or other oxides. Current efforts and key results are described.

6173 (CONF-770318—, pp 593-605) **GaAs thin-film solar cells.** Fan, J.C.C. (MIT, Lexington, MA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

On the basis of its exploratory studies, Lincoln Laboratory proposes a research and development program on GaAs thin-film solar cells, with the aim of demonstrating the feasibility of fabricating efficient, inexpensive cells for large-scale terrestrial applications. This program will address the two principal problems involved in the fabrication process: preparation of large-grained GaAs films and formation of barriers for charge separation.

6174 (CONF-770318—, pp 606-625) **High-efficiency thin-film GaAs solar cells.** Stirn, R.J. (California Inst. of Tech., Pasadena). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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A program to investigate the feasibility of growing large-grain polycrystalline GaAs by chemical vapor deposition on recrystallized GE films, to fabricate AMOS (Antireflection-Coated Metal-Oxide-Semiconductor) solar cells on these films, and to further investigate the physics of AMOS cells on single crystals began in January 1976. Considerable improvements have been observed in the I-V characteristics of single-crystal AMOS solar cells, in which the oxide was grown by room-temperature exposure to water vapor-saturated O_2, although the best efficiencies have remained in the 15 to 16% range.

6175 (CONF-770318—, pp 626-643) **Polycrystalline thin film gallium arsenide solar cells.** Borrego, J.M.; Ghandhi, S.K. (Rennselaer Polytechnic Inst., Troy, NY). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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The objective of this program is to investigate a new approach to energy conversion, based on the use of thin films of III-V compound semiconductors. The initial effort will be conducted on single crystal layers of GaAs for the purpose of developing the device physics; however, polycrystalline layers will be used in the final cell structure. A highly transparent, conductive layer will be evaluated as the upper contact for this structure, with doped tin-oxide as a viable candidate.

6176 (CONF-770318—, pp 644-662) **Thin films of GaAs on low cost substrates.** Dapkus, P.D. (Rockwell International, Anaheim, CA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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A program to grow thin films of GaAs and GaAlAs on low-cost substrates for application to thin-film solar cells is being pursued at the Rockwell Electronics Research Center. The films are being grown by the metallorganic chemical vapor deposition techniques on selected low cost substrates and improve the quality of these films so that thin-film solar cells with 10% AM1 efficiency can be fabricated. Results to date are discussed.

6177 (CONF-770318—, pp 663-681) **Thin films of gallium arsenide on low-cost substrates.** Chu, S.S. (Southern Methodist Univ., Dallas). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

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The objective of this program is to conduct intensive studies of thin films of gallium arsenide on low cost substrates as an initial step for the fabrication of low cost solar cells of relatively high efficiency. Work during the past six months has been directed to (1) the construction of gallium arsenide deposition systems, (2) the deposition of gallium arsenide films on single crystalline gallium arsenide and germanium substrates, (3) the preparation of foreign substrates, and (4) the deposition and characterization of gallium arsenide films on foreign substrates.

6178 (CONF-770318—, pp 682-698) **Thin films of GaAs on low-cost substrates.** James, L.W. (Varian Associates, Palo Alto, CA). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The objective of this program is the development of technology to permit production of thin film GaAs solar cells on low-cost substrates. Results to date and planned activities are discussed.

6179 (CONF-770318—, pp 564-592) **Investigation of low cost solar cells based on Cu_2O.** Olsen, L.C. (Univ. of Washington, Richland). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

Investigations of Cu_2O Schottky barriers to determine an approach to minimizing the surface state density are described. It is expected that the demonstrated 1% AM1 efficiency will be significantly improved. Heterojunction studies will be initiated and a low level effort will continue on backwall cells.

6180 (DSE/2457—2) **Improved semiconductors for photovoltaic solar cells. Quarterly report No. 2, October 1—December 31, 1976.** (Temple Univ., Philadelphia, Pa. (USA). Dept. of Chemistry). 25 Jan 1977. Contract EX-76-C-01-2457. 8p. Dep. NTIS, PC A03/MF A01.

In the second quarter of this effort, the Monosolar-USC team has been successful in electrochemically depositing homogeneous pinhole-free films of cadmium telluride and cadmium telluride alloys on light-transparent tin dioxide coatings over Pyrex glass substrates. Simultaneously, work on characterizing these films became a task of major importance. It became apparent that impurities in various processing chemicals used masked the intrinsic conductivities of the semiconductors and that means to eliminate these spurious materials would be needed. Impurities have been reduced to a level wherein it is possible now to grow CdTe layers electrochemically of either p- or n-type conductivity by changing the deposition potentials. N-type

material also was produced by simultanously electrochemically depositing indium dopant along with the cadmium telluride.

6181 (ERDA/JPL/954334—77/2) **Low cost silicon solar array project. Establishment of the feasibility of a process capable of low cost, high volume production of silane (Phase I), and the pyrolysis of silane to semiconductor-grade silicon (Phase II). Quarterly progress report, January—March 1977.** Breneman, W.C.; Farier, E.G.; Mui, J.Y.P.; Rexer, J. (Union Carbide Corp., Sistersville, W.Va. (USA); Union Carbide Corp., Parma, Ohio (USA). Carbon Products Div.). 1977. Contract NAS-7-100-954334. 66p. Dep. NTIS, PC A04/MF A01.

A mini-plant for producing silane from dichlorosilane via a redistribution reaction has produced 97% pure SiH_4 at 93% efficiency. The residual impurities were monochlorosilane (2.5%) and dichlorosilane (.5%). The silane purity of 97% achieved by operating the silane still partial condenser at 40 psig and -32°C outlet temperature was significantly higher than predicted by ideal vapor-liquid equilibrium considerations. Laboratory equilibrium concentrations and order of magnitude reaction rates were confirmed in mini-plant operations. Kinetic isotope studies on the mechanism of the amine catalyzed redistribution of chlorosilanes indicated the amine hydrochloride may not be the active species as originally proposed. The hydrogenation of silicon tetrachloride to trichlorosilane appears to be a true equilibrium, approachable from either $HSiCl_3$ or $SiCl_4$. Virtually no H_2SiCl_2 was formed by hydrogenation of $HSiCl_3$.

6182 (ERDA/JPL/954344—77/2) **Web-dendritic ribbon growth. USC solar report No. Q-6. Quarterly report, April 1, 1977—June 30, 1977.** Hilborn, R.B. Jr.; Faust, J.W. Jr. (South Carolina Univ., Columbia (USA). Coll. of Engineering). 27 Jun 1977. Contract NAS-7-100-954344. 9p. Dep. NTIS, PC A02/MF A01.

Work on the web-dendritic ribbon growth process at the University of South Carolina (USC) is reported. The goal of the over-all program is to develop a multivariate semi-empirical computer model for use in understanding the web-dendritic process and defining the basic limitations of the process with particular regard to the growth rate and width. The goal of the extension program is to determine the maximum length of pull and width of the ribbon attainable in the USC facility using a tapered, four-inch diameter susceptor. Recommended changes in facility design are determined which would increase the length of pull and the width of the ribbon.

6183 (ERDA/JPL/954350—77/2) **Large area silicon sheet task low-cost silicon solar array project. Sixth quarterly progress report, 4 April 1977—1 July 1977.** Garfinkel, M.; Hall, R.N. (General Electric Co., Schenectady, N.Y. (USA)). 11 Jul 1977. Contract NAS-7-100-954350. 16p. Dep. NTIS, PC A04/MF A01.

Silicon ribbons were grown in the presence of some air backstreaming and were consistently polycrystalline with little evidence of oriented growth from the seed. The problem of back-diffusion of air from the exit port has been eliminated, and clean growth conditions, as determined by silicon wafer film test, have been obtained in the redesigned seeded growth furnace. This furnace developed a water leak in the cooling nozzle, so it has not as yet been used to grow silicon. A new, vertical seeded growth furnace, which permits the seeding and initial crystal growth to take place below the alloy surface, has been designed and is being built.

6184 (ERDA/JPL/954355—77/1) **Large area silicon sheet by EFG. First quarterly report, January 1, 1977—March 31, 1977.** Mackintosh, B.H.; Morrison, A.D.; Rao, C.V.H.N.; Ravi, K.V.; Serreze, H.B.; Surek, T.; Wald, F.V.; Yates, D.A. (Mobil Tyco Solar Energy Corp., Waltham, Mass. (USA)). 15 Mar 1977. Contract NAS-7-100-954355. 65p. Dep. NTIS, PC A04/MF A01.

Work on an existing multiple growth furnace has begun with the aim of achieving growth of 5, 2" wide ribbons simultaneously at a rate of 3 in./min. The equipment and the initial experiments carried out are described. Also starting is a task aiming to bring the 5 ribbons under automatic control, equally using pre-existing equipment and designs. Furthermore, the effort to characterize the EFG (edge-defined film-fed growth) materials produced is increased and particular emphasis is placed on measuring and analyzing their solar cell performance. Data are presented on defect densities in various EFG grown ribbons. It is demonstrated that the diffusion length is larger under AM1 than under "dark" conditions, and results are shown on electrical inhomogeneities in the ribbon cells. Many of these results are interpreted in terms of defect-impurity interactions which are believed to be the main impediment to better solar cell performance at the present time. However, data are reported on an EFG solar cell of 12% AM1 efficiency, and on several 1" x 4" EFG cells of efficiencies between 9 and 11%. In the single ribbon resistance heated crystal growth station, a major effort is made to identify the sources of impurities introduced during growth by testing a variety of machine components and designs. Also work is being started to evaluate how 3" wide ribbons with low grown-in stress may be produced at rates of up to 3 in./min. These efforts are described in some detail.

6185 (ERDA/JPL/954355—77/2) **Large area silicon sheet by EFG. Second quarterly report, April 1, 1977—June 30, 1977.** Wald, F.V. (Mobil Tyco Solar Energy Corp., Waltham, Mass. (USA)). 15 Jun 1977. Contract NAS-7-100-954355. 107p. Dep. NTIS, PC A06/MF A01.

During the quarter on which this document reports significant amounts of 2" wide ribbon have been grown from both growth systems at speeds up to 2"/min. Solar cells prepared from the material have shown conversion efficiencies up to 8% (AM1). Thus, it is believed that the basic effort to produce reasonably clean conditions in these resistance heated furnaces has succeeded. However, the ribbons produced show a cross-sectional structure which is significantly different from that of induction furnace grown ribbon (1" wide at a rate of 1"/min). Also, the ribbon produced in this program has unusually large inhomogeneities across its width. Some hypotheses to explain both of these features are advanced and the possible implications for solar cell performance are touched upon. The multiple ribbon growth system (JPL No. 3A) has shown a number of flaws with respect to the reliability of the basic furnace design. These definitely need to be rectified before any significant demonstration of multiple ribbon growth can proceed. The cartridges, however, have performed quite well. The work on 3" cartridge design and automatic controls has proceeded nearly on schedule and the report contains a detailed description of the approach and the equipment to be used for automatic control of ribbon width.

6186 (ERDA/JPL/954373—77/2) **Heat exchanger-ingot casting/slicing process. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Seventh quarterly progress report, March 22, 1977—June 30, 1977.** Schmid, F.; Khattak, C.P. (Crystal Systems, Inc., Salem, Mass. (USA)). 1 Jul 1977. Contract NAS-7-100-954373. 46p. Dep. NTIS, PC A03/MF A01.

Efforts in crystal casting during the last quarter were directed towards obtaining crack-free, single crystal boules. A crack-free 15 cm diameter silicon ingot has been cast using thin-wall, clear silica crucibles. A number of crack-free ingots have been solidified on smaller scales using sintered silica liners and coatings. Single crystal growth has been achieved all the way to the top of the seed as well as laterally to the crucible walls. Sixty-four wafers per inch (5-7mils, 0.125-0.175mm thick) were sliced using fixed diamond abrasive particles. The diamond impregnated wire fails because of diamond pull-out, thereby having shorter life as compared to the diamond plated wire. Impregnation of diamond can be carried out to high concentrations in house. This wire after plating is expected to yield a suitable blade for silicon slicing. A cost analysis has shown that the cost of expendable materials, diamond and wire, are negligible for slicing silicon with fixed diamond abrasive.

6187 (ERDA/JPL/954527—77/2) **Investigation of test methods, material properties, and processes for solar cell encapsulants. Annual report.** Willis, P.B.; Baum, B.; White, R.; Kucejko, R. (Springborn Labs., Inc., Enfield, Conn. (USA)). Sep 1977. Contract NAS-7-100-954527. 169p. Dep. NTIS, PC A08/MF A01.

This is the first annual report in a program to identify and recommend polymers for use as encapsulants in solar cell arrays. Material properties are reported for controls and specimens exposed to indoor accelerated aging conditions. Trial encapsulations of miniaturized solar modules are described.

6188 (ERDA/NASA/1022—76/7) **Sensitivity of solar-cell performance to atmospheric variables. II. Dissimilar cells at several locations. Technical report II-8.** Klucher, T.M.; Hart, R.E. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1976. Contract EX-76-A-29-1022. 16p. (CONF-761129—11). Dep. NTIS, PC A02/MF A01.

From Terrestrial PV measurements workshop; Baton Rouge, Louisiana, United States of America (USA) (10 Nov 1976).

Fifteen solar cells, having dissimilar spectral response curves and cell construction, were measured at various locations in the United States to determine sensitivity of cell performance to atmospheric water vapor and turbidity. The locations selected represent a broad range of summer atmospheric conditions, from clear and dry to turbid and humid. Cell short-circuit current under direct normal incidence sunlight, the intensity, water vapor and turbidity were measured. Regression equations were developed from the limited data base in order to provide a single method of prediction of cell current sensitivity to the atmospheric variables.

6189 (NSF-AER—75-23453-5) **Cuprous oxide photovoltaic cells. Fifth quarterly report, October 1, 1976—December 31, 1976.** Trivich, D. (Wayne State Univ., Detroit, Mich. (USA). Dept. of Chemistry). 1976. 15p. Dep. NTIS, PC A03/MF A01.

This project is concerned with cuprous oxide photovolatic cells. The cuprous oxide is prepared by oxidation of copper sheet at high temperatures. Front wall cells of the Schottky barrier type are prepared by vacuum evaporation of thin metal coatings on the Cu_2O sheets. A number of metal contacts have been studied. The experi-

mental conversion efficiency of the best cells approaches 1%. Progress during this period is reported.

6190 (PB—265003) **Ternary compound thin film solar cells. First quarter report, September 1—December 31, 1976.** Kazmerski, L.L. (Maine Univ., Orono (USA). Dept. of Electrical Engineering). Jan 1977. 68p. Dep. NTIS, PC A04/MF A01.

$CuInTe_2$ thin films were investigated. The growth and structural characterization of vacuum deposited, n- and p-type $CuInTe_2$ thin films, utilizing a high evaporation - rate technique (>100A/sec), are reported. Complementary transmission electron microscopy (TEM) and Auger electron microscopy (AES) are used to investigate the films' crystalline and compositional properties. A substrate-temperature range (4000<T/sub sub/ <525K) has been identified for the growth of single phase, chalcopyrite $CuInTe_2$. The electrical properties - mobility, conductivity, carrier type and carrier concentration - are reported. A thin-film $CdS/CuInTe_2$ heterojunction has been fabricated. Dark IV-characteristics are presented for in-situ provided devices. The photovoltaic effect for this heterostructure is discussed. Finally, the fabrication and characterization of n, p-$CuInS_2$ thin film homojunction solar cells are presented. Dark and light IV-characteristics are reported for 0.124 cm^2 devices, with typical parameters: eta - 3.33%, V/sub oc/ = 0.41v,I/sub sc/ = 2.34 mA and FF = 0.43. A best efficiency of 3.52% is cited. Spectral response characteristics are presented, and device stability is discussed.

6191 **Photovoltaic effect applications.** Califano, F.P. pp 515-533 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

With current technological background, it looks possible to produce solar cell modules for terrestrial applications at a non-prohibitive cost. Recent developments, such as the ribbon-type silicon and the compound-semiconductor hetero-functions, are important steps towards cost reduction and massive solar cell production. New materials and structures, such as metal-semiconductor and poly-crystalline cells are being studied. This paper reviews the different approaches for the realization of solar cell modules for terrestrial applications and indicates the state of the art and the perspectives.

6192 **Analysis of silicon solar cell parameters for terrestrial applications.** Wang, E.Y. (Wayne State Univ., Detroit). pp 534-549 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The excess junction current and the series resistance have a significant effect on the fill factor of the silicon solar cells for terrestrial applications. This is especially true for diffused solar intensity, concentrated optical systems, and low resistivity solar cells. It is the purpose of this paper to investigate the effect of the excess junction currents and series resistance on the silicon solar cell parameters for terrestrial applications.

6193 **Deposition of polycrystalline silicon solar cells.** Brissot, J.J.; Belouet, C. (Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes, France). pp 550-562 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The deposition of polycrystalline silicon layers on a conductive substrate appears to be a most promising method for achieving low cost solar cells. In 1962, such devices were prepared by depositing silicon onto graphite from the melt; the conversion efficiency was around 5 to 6%. A new procedure being studied allows the deposition of layers whose thickness can be controlled, and which exhibit crystallographically well oriented grains.

6194 **Silicon ribbon solar cell.** Ravi, K.V.; Mlavasky, A.I. (Mobil Tyco Solar Energy Corp., Waltham, MA). pp 563-587 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The technique of growing ribbon shaped crystals of silicon by the edge-defined, film-fed growth (EFG) process is discussed. A discussion of the growth process is followed by an analysis of the ribbon quality. A detailed economic analysis indicates that low cost photovoltaic systems can be realized through the use of this technology.

6195 **Thin film heterojunctions for terrestrial solar cells.** Martinuzzi, S. (Aix-Marseille Univ III). pp 588-607 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Frontwall and backwall photocells prepared from thin film heterojunctions for low efficiency, low cost terrestrial photovoltaic conversion are studied. First, backwall photocells made of CdTe-CdS heterojunctions are investigated. Then Cu_2S-CdS thin film heterojunctions are discussed: their structure, chemical analysis, conduction processes, spectral sensitivity, and stability. Modification by CdS-ZnS alloyed films led to an increase to the band gap of these frontwall photocells.

6196 **Thin-layered CdS--Cu_2S solar cells: long duration illumination, humid atmosphere.** Martin, C.; Cacheux, J. (Centre National d'Etudes Spatiales, Toulouse). pp 608-616 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Test results are presented on the effects of illumination and humidity on Cu_2S--CdS solar cells. The test conditions represent those found on geostationary satellites. After 7000 hrs of illumination the tested cells are still very stable and if one considers the mean energy received at the ground this corresponds to six years of terrestrial testing. Moreover, there was found no evidence of degradation on cells placed in humid areas for more than a year. This shows that the coating of the cell is almost impermeable.

6197 **Evolution of the conduction with illumination in Cu_2S--CdS photocells.** Luquet, H.; Moussalli, G.M.; Bougnot, J.; Savelli, M. (Universite des Sciences et Techniques du Languedoc, Montpellier, France). pp 617-623 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Studies are presented relative to an assembly of Cu_2S--CdS solar cells. The knowledge of the mode of conduction in darkness made it possible to predict the shape of the I-V characteristics under illumination. The slopes observed led to a study of photocells working without illumination. The electric measurements were made at several temperatures. Modifications made to the conduction mechanism by light are discussed.

6198 **Sulfurization process for the preparation of photovoltaic Cu/sub x/S and $CuInS_2$ thin films.** Shewchun, J.; Loferski, J.J. (Brown Univ., Providence). pp 624-642 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The preparation of Cu_2S films with present techniques is extremely difficult. For this reason a technique has been developed involving the control of the partial pressure of sulfur by passing a flowing mixture of hydrogen sulfide, argon and hydrogen over copper films evaporated on various substrates. $CuInS_2$ films can also be formed in the same way by sputtering CuIn films onto substrates. By adjusting the hydrogen/hydrogen-sulfide ratio and the reaction time, various phases of the Cu/sub x/S system can be produced. Characterizations of these films was made and photovoltaic junctions were formed with Cu/sub x/S films on silicon and cadmium sulfide.

6199 **Cuprous oxide Schottky photovoltaic cells as potential solar energy converters.** Wang, E.Y.; Trivich, D.; Sawalha, H.; Thomas, G. (Wayne State Univ., Detroit). pp 643-650 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Cuprous oxide, a relatively low cost material, could lead to useful photovoltaic cells. This paper presents calculations of the potential conversion efficiency of cuprous oxide Schottky diodes. A semi-empirical analysis leads to an estimated efficiency of about 3 percent with a fill factor of 0.48. Directions for further improvement are identified, and the ultimate efficiency could reach 12 percent. An

economic analysis of a large scale utilization of cuprous oxide cells is compared to silicon cells for terrestrial application, and shows that such cells could be a viable alternative.

6200 Photovoltaic systems using sunlight concentration. Backus, C.E. (Arizona State Univ., Tempe, AZ); Evans, D.L.; Ralph, E.L. pp 653-667 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The main factors affecting the cost and efficiency of photovoltaic systems using sunlight concentration are reviewed. Cell encapsulation, bonding materials, and concentrators are evaluated, and heat rejection is analyzed. The component characteristics are incorporated into a computer program to simulate system performance and conduct cost analysis. Preliminary results are presented.

6201 Double-faced silicon solar cell system. Anwar, M.M. (Institute of Nuclear Research and Tech., Rawalpindi, Pakistan). pp 668-674 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A solar cell active on both sides was designed. It requires special connections to the p- and n-layers. Such cells are mounted in a panel at a distance of a flat mirror. The panel is kept fixed and provides 70 to 80 percent additional power. This paper describes the fabrication of these special cells and discusses their costs.

6202 Meeting electric power needs with photovoltaic power systems. Ralph, E.L.; Shahryar, I.M. (Spectrolab, Inc., Sylmar, CA). pp 675-681 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

This paper reports the development of new processes for the manufacture of solar cells, performed without use of vacuum chambers and expensive masking techniques, thus providing the possibility of reduced costs by automation using conventional semiconductor processing machinery. The contacts are printed on the cells by conventional silk screen machinery. The p+ back field is formed by diffusing aluminum from a printed back contact. The anti-reflection coating is formed by spinning and baking a TiO_2-SiO_2 glass film. Air mass zero efficiencies of over 10 percent and high reliability were achieved.

6203 Encapsulation of solar cell modules. Dalibot, B. (La Radiotechnique-Compelec, Paris). pp 682-686 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A brief description of the technology of encapsulation and photographs of operating solar modules are presented.

6204 Water pumps driven by photovoltaic modules. Durand, H.; Naaijer, G.J. (Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes, France). pp 315-330 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Two water pumping systems including a kilowatt-size photovoltaic generator combined with a short-term storage battery are described. One system consists of a 300 Watt-peak solar generator and a 1.8 kW pump. Another one consists of a 500 Watt-peak generator coupled to a 400 Watts pump. A comparison with a thermal steam-engine shows definite advantages in favor of the photovoltaic solution. The expected drop in prices and improvements of solar panels would make megawatt size stations economical for large scale irrigation and full electrification of arid and remote areas.

BIOMASS PRODUCTION AND CONVERSION

6205 (BMI—1957A(Vol.4)) **Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn. Volume IV. Corn agriculture. Task 77, final report.** Lipinsky, E.S.; McClure, T.A.; Otis, J.L.; Scantland, D.A.; Sheppard, W.J. (Battelle Columbus Labs., Ohio (USA)). 31 Mar 1977. Contract W-7405-ENG-92. 211p. Dep. NTIS, PC A10/MF A01.

Findings of field interviews and literature research are reported. Information on the cultivation of corn, yields, composition, and unit costs is presented. Mass balance of mineral nutrients, composition and heating value, and energy balance are discussed. It is concluded that corn can make a limited, but more than negligible, contribution to the future U.S. fuels supply. There are long-range technical improvements in the processing of the residues from corn grain production that could lead to brighter prospects, but research is in an embryonic stage.

6206 (BMI—1957(Vol.1)) **Systems study of fuels from sugarcane, sweet sorghum, and sugar beets. Volume I. Comprehensive evaluation. Task 77, final report.** Lipinsky, E.S.; Nathan, R.A.; Sheppard, W.J.; McClure, T.A.; Lawhon, W.T.; Otis, J.L. (Battelle Columbus Labs., Ohio (USA)). 15 Mar 1977. Contract W-7405-ENG-92. 169p. Dep. NTIS, PC A08/MF A01.

Results of a comprehensive evaluation of sugar crops as renewable resources for production of fuels and chemical feedstocks are reported. Volume I contains the general systems analysis of using sugar crops as raw materials for production of fuels and chemical feedstocks, along with a discussion of the major issues affecting the feasibility and implementation of this concept. A technical economic analysis of the substitutability of sugar crop products for nonrenewable resources was also developed so that alternatives can be placed in perspective. Finally, research, development and demonstration needs relating to the development of sugar crops as renewable resources for the manufacture of fuels and chemical feedstocks are discussed. (JB)

6207 (BMI—1957(Vol.3)) **Systems study of fuels from sugarcane, sweet sorghum, and sugar beets. Volume III. Conversion to fuels and chemical feedstocks. Task 77. Final report.** Lipinsky, E.S.; Nathan, R.A.; Sheppard, W.J.; Otis, J.L. (Battelle Columbus Labs., Ohio (USA)). 31 Dec 1976. Contract W-7405-ENG-92. 183p. Dep. NTIS, PC A09/MF A01.

Information developed in field interviews and literature research which form the basis of extensive calculations that pertain to numerous alternative means of converting the sugar crops into fuels and chemical feedstocks is reported. Investigation of numerous candidate fuels and chemical feedstocks that might be made from sugar crops indicates that ethanol and ammonia are the most promising. The projected cost of ethanol by use of well-established fermentation technology on juice extracted from sugarcane or on molasses is expected to be quite close to that projected for ethanol from natural gas liquids or petroleum by 1980. The ammonia market is substantial (17 million tons), but this key fertilizer and chemical product is expected to cost close to $200 per ton when made from sugar crop residues, well above what ammonia made from natural gas at $3 per million Btu costs. However, sugarcane-based ammonia might compete well with coal-based ammonia. Sugarcane appears to be the most promising sugar crop for conversion to fuels and chemicals in the short and intermediate term. The costs of sugarcane juice and bagasse are lower than for the corresponding sugar beet products. Of the sugar crops, sweet sorghum has the greatest long-range appeal for the United States because the crop can grow over a much wider geographical range than can sugarcane. The development of processes to manufacture ammonia, methanol, acetic acid, and thermochemical substitute natural gas (SNG) from sugar crop residues depends on technology to generate synthesis gas. Sugarcane bagasse appears to be the most economic source of furfural. Anaerobic digestion of sugarcane or sugan-containing juices to SNG is ruled out on economic grounds. The principal findings of the conversion aspects of the research are summarized quantitatively. Alternative routes for conversion of sugar crops to fuels and chemicals are presented.

6208 (CONF-7601156—1) **Silvichemicals and fuels from Paraquat: treated pine trees.** Bungay, H.R.; Ward, R.W. (Rensselaer Polytechnic Inst., Troy, N.Y. (USA)). 1976. Contract EG-77-G-01-4001. 4p. Dep. NTIS, PC A02/MF A01.

From Lightwood coordinating conference; Jacksonville, Florida, United States of America (USA) (19 Jan 1976).

Various aspects of the conversion of biomass to fuels and chemical feedstocks are discussed. It is pointed out that pine trees become a more attractive biomass source, if the fast growth rate of certain species is considered. In addition a three-fold increase in oleoresin formation has been observed when the trees are treated with paraquat during cultivation, thus making the silvichemicals produced more economical. (JGB)

6209 (COO/2917—4) **Biological conversion of biomass to methane. Quarterly progress report, December 1, 1976—March 31, 1977.** Pfeffer, J.T. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). Apr 1977. Contract EY-76-S-02-2917. 26p. Dep. NTIS, PC A03/MF A01.

Progress is reported in research on the development of optimum conditions for the production of methane from organic materials by fermentation. Beef lot and dairy herd manures were used in tests of three types of reactors constructed for the study. They are

complete mixed, two-stage, and plug flow reactors. Although there are variations in the data collected, preliminary results indicate that the complete mix reactor exhibits better methane production than either of the other two reactor designs. (JGB)

6210 (UCRL—79299) **Growth of filamentous blue-green algae at high temperatures: a source of biomass for renewable fuels.** Timourian, H.; Ward, R.L.; Jeffries, T.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Aug 1977. Contract W-7405-ENG-48. 31p. (CONF-770840—1). Dep. NTIS, PC A03/MF A01.

From 9. international seaweed symposium; Santa Barbara, California, USA (20 Aug 1977).

The growth of filamentous blue-green algae (FBGA) at high temperatures in outdoor, shallow solar ponds is being investigated. The temperature of the 60-m^2 ponds can be controlled to an average temperature of 45°C. The growth of FBGA at high temperatures offers an opportunity, not presently available from outdoor algal ponds or energy farms, to obtain large amounts of biomass. Growth of algae at high temperatures results in higher yields because of increased growth rate, the higher light intensity that can be used before saturating the photosynthetic process, easier maintenance of selected FBGA strains, and fewer predators to decimate culture. Additional advantages of growing FBGA as a source of biomass include: bypassing the limitations of nutrient sources, because FBGA fix their own nitrogen and require only CO_2 when inorganic nutrients are recycled; toleration of higher salinity and metal ion concentrations; and easier and less expensive harvesting procedures.

6211 (UCRL—79716) **Methane from algae grown in desert regions of California using available ground waters.** Ward, R.L.; Jeffries, T.W.; Timourian, H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1977. Contract W-7405-ENG-48. 17p. (CONF-770727—1). Dep. NTIS, PC A02/MF A01.

From Workshop on energy resources conservation; Sacramento, California, USA (14 Jul 1977).

The potential for growing thermophilic filamentous blue-green algae in the California desert is discussed. Filamentous blue-green algae grow well at elevated temperatures under high solar radiation in water containing a wide range of dissolved solids. The physical characteristics of filamentous blue-greens makes them easier and less expensive to harvest than unicellular algae forms and once harvested can be readily converted to methane gas by anaerobic digestion. An artist's concept of the proposal is presented. Various factors involved in such a project are considered. They include: productivity, carbon dioxide sparging, high solar insolation, water, anaerobic digestion, suitability of desert resources, special requirements (including water, nutrients, and sunlight), shallow solar pond system, and cost estimates. (JGB)

6212 **Eucalyptus fuel plantation to generate electricity.** Mariani, E.O. (Marelco, Inc., Beverly Hills, CA). pp 753-758 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The feasibility of collecting and fixing solar energy through photosynthesis is discussed. Planting Eucalyptus trees, harvested, processed and used as fuel in a steam-electric-power plant, is one of the simple and straight forward solutions to use solar energy.

6213 **Agricultural and biological applications in an integrated solar energy system.** Abdel-Hameed, M.F.; El-Difrawi, A.A.; Soliman, M.A.; Hasan, M. (Northern Illinois Univ., DeKalb). pp 249-273 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

An integrated cycle-like system for maximum utilization of solar energy is proposed. The agricultural and biological applications are designed to utilize fresh water produced at various stages of the cycle and to investigate: cultivation of arable and marginal soils; production of high yield-high protein strains; increased production of conventional animal proteins; production of unconventional but edible animal proteins using solar arks; photosynthesizing animal cell cultures; solar energy for petrochemical food sources; and management to coordinate various processes of the cycle. The objective is to develop integrated modules self sufficient in food, water, and energy.

6214 **Effect of the oasis on the solar radiation compared with the desert environment.** El-Amami, S. (INRAT, Tunisie). pp 340-345 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Microclimatic prospecting done at the Gabes oasis showed the important role of staged cultures on the reduction of total solar radiation with respect to the desert environment. This reduction is of the order of more than 50 percent and explains in large part the ameliorating effect of the oasis at the level of the potential evapotranspiration, which itself is reduced by half with respect to the desert steppe. In conclusion, the planning model for the irrigation of desert zones should correspond to that of traditional oases with several stages of culture: date palm - fruit orchards, herebaceous cultures.

6215 **Solar distillation for intensive cultivation in arid lands.** Frick, G.; Retamal, M. (Universidad Tecnica Federico Santa Maria, Valparaiso). pp 401-412 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This study proposes the use of hermetically-sealed cultivation tents for agriculture in the deserts of Northern Chile. These tents permit the reuse of water and act as efficient solar stills. This paper describes these tents and their operation. It concludes with a demonstration of their economic feasibility.

PHOTOCHEMICAL CONVERSION

REFER ALSO TO CITATION(S) 6104, 6123, 7175

6216 (CONF-770318—, pp 403-424) **Photochemical conversion of solar energy.** Lichtin, N.N. (Boston Univ.). 1977.

From Meeting of the ERDA semiannual photovoltaic advanced materials program review; Washington, District of Columbia, United States of America (USA) (22 Mar 1977).

In Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting.

The overall objective of the project is the development of a photogalvanic cell with five percent engineering efficiency for conversion of incident solar energy to electricity. The longer range objective is the development of a light recharged storage battery. Results to date are described.

6217 **Investigation of a TiO_2/electrolyte solar cell and the photocatalytic water decomposition.** Gissler, W. (Joint Nuclear Research Center, Ispra, Italy). pp 708-719 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

To demonstrate the feasibility of semiconductor/electrolyte solar cells a TiO_2/0.1 m Na_2SO_4/Pt cell has been constructed and tested. The quantum efficiency of the cell was 85 percent. This rather high value could be achieved by a systematic analysis of different sample preparation techniques. However, due to the large band gap of 3.06 eV, the solar energy conversion efficiency is small. The possibility of a photocatalytic water decomposition has been investigated at very high light intensities corresponding to about 100 Sun intensities. The result was negative.

6218 **Alternating photoelectrochemical converters.** David, J.P.; Aiache, L. (Universite d'Aix-Marseille III). pp 689-707 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The various limitations of photoelectrochemical converters are reviewed and some examples of photoelectrochemical cells are given. The possibility of working by alternately lighting the two electrodes leads to the suppression of the activation polarization and to a report of the appearance of the diffusion polarization for very high current densities. In these alternating converters the active medium is capable of showing spontaneous concentration oscillations. For such cells, one can imagine a coupling between the concentration oscillations and the alternative illumination; this permits an amplification by resonance and a stabilization of the chemical oscillations.

PHOTOVOLTAIC POWER PLANTS

6219 (CONF-770403—3) **Impact of solar energy on electric utility generation system reliability and operations.** Jordan, G.A.;

Moisan, R.W.; O'Brien, G.P. (General Electric Co., Schenectady, N.Y. (USA)). 1977. vp. TIC.

From 39. annual meeting of the American Power Conference; Chicago, Illinois, United States of America (USA) (18 Apr 1977).

Generation system reliability and operations with photovoltaic electric power systems on the electric utility system were discussed. Over the years, the utility industry has developed a methodology to evaluate conventional thermal generation consisting of system reliability and production cost calculations. Although these methods might have to be modified slightly, it is important that new forms of generation be evaluated in a consistent manner. How these modifications can be accomplished to handle an intermittent power source such as solar photovoltaic power plants was shown. Results were presented which illustrate the usage of this approach. Applications of this method, when coupled with assessments of capital cost requirements will yield estimates of photovoltaic electric power system value in actual utility systems.

6220 Economic viability of pursuing a space power system concept. Hazelrigg, G.A. Jr. (ECON, Inc., Princeton, NJ). *J. Energy;* **1**: No. 2, 93-99(1977).

Space power systems (SPS) offer the potential for providing a vast quantity of electrical power in an environmentally clean manner that does not rely heavily upon nonrenewable resources. However, the project would represent man's most ambitious endeavor in space to date—one which is fraught with uncertainties. This paper addresses the economic uncertainties surrounding SPS and specifically focuses on the economic viability of pursuing the SPS concept. The existing state-of-knowledge relevant to a photovoltaic concept SPS is quantified and used to evaluate and compare programmatic options using a decision tree approach. The approach taken provides a measure of program success or failure at various stages of concept development and implementation and provides a mechanism for typing together the engineering and economic aspects of system design.

SOLAR THERMAL POWER PLANTS

REFER ALSO TO CITATION(S) 6119, 6130, 6322, 6677

6221 Alternative approaches to space-based power generation. Gregory, D.L. (Boeing Aerospace Co., Seattle). *J. Energy;* **1**: No. 2, 85-92(1977).

Satellite Power Stations (SPS) would generate electrical power in space for terrestrial use. Their geosynchronous orbit location permits continuous microwave power transmission to ground receiving antenna farms. Eight approaches to the generation of the electrical power to be transmitted were investigated. Configurations implementing these approaches were developed through an optimization process intended to yield the lowest cost for each. A complete program was baselined for each approach, identifying required production rates, quantities of launches, required facilities, etc. Each program was costed, including the associated launches, orbital assembly, and maintenance operations. The required electric power charges to amortize these costs were calculated. They range from 26 to 82 mills/kWh (ground busbar).

6222 Solar thermal power generation. Teagan, W.P.; Atallah, S.; Glaser, P.E. (Arthur D. Little, Inc., Cambridge, MA). pp 720-738 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

This paper discusses the preliminary design and feasibility analysis of a 100-kW electric generation station utilizing solar energy. The primary components of the system are an advanced flat-plate solar collector array and a Rankine-cycle engine which utilizes an organic fluid. Preliminary estimates for the cost of power generated by the proposed facility lies between 3.9 and 6.8 cents/kWhr. A marked improvement in collection efficiency can be realized by the addition of a simple reflector system which in turn would reduce the cost of power generation by 15 to 30 percent.

6223 Hydel and solar power for Pakistan. Khan, M.I. (Univ. of Engineering and Tech., Lahore). pp 576-582 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper reviews the energy resources of Pakistan, and makes projection for future needs. If Pakistan is to implement its development plans and increase energy self-sufficiency, it should develop its two principal energy resources: hydel and solar.

CENTRAL RECEIVER

REFER ALSO TO CITATION(S) 6143, 6347

6224 (SAN/1109—76/4) **Solar pilot plant, phase I. Quarterly report No. 4, July—September 1976.** (National Oceanic and Atmospheric Administration, Kansas City, Mo. (USA). National Severe Storms Forecast Center). 15 Jan 1977. Contract E(04-3)-1109. 102p. Dep. NTIS, PC A06/MF A01.

The technical and economic feasibility of generating electricity from solar energy is being studied. Collector experiments included heliostat tests. Hardware preparation and assembly constituted the steam generator work. The thermal storage subsystem research experiment, which featured thermal energy storage in a sodium nitrite/sodium hydroxide phase-change mixture, was discontinued. Analytical and design work on the electrical generation subsystem and plant integration progressed satisfactorily. (MHR)

6225 (SAND—77-0582) **OPTICAL analysis of solar facility heliostats.** Igel, E.; Hughes, R.L. (Sandia Labs., Albuquerque, N.Mex. (USA)). May 1977. Contract EY-76-C-04-0789. 49p. Dep. NTIS, PC A03/MF A01.

An experimentally verified simple analytical model, based on classical optical aberrations, is derived and predicts the power reception of a central receiver solar facility. A laboratory simulation was made of a typical heliostat, and its images were photographed and measured at several angles of incidence. The analytically predicted image size is in agreement with experiment to within less than 10% over an incident angle range of 60 degrees. Image size for several of the heliostats in the Sandia-ERDA Solar Thermal Test Facility array were calculated throughout a day and compared with ideal images and the size of the receiver. The optical parameters of the system and the motion of the sun were found to severely affect the design and optimization of any solar thermal facility. This analysis shows that it is the aberration astigmatism which governs the solar image size at the receiver. Image growth is minimal when heliostats are used at small angles of incidence, which usually corresponds to a limited operating time of two to three hours. However, image size is markedly increased at large angles of incidence. The principal result is that the predominant sources of image enlargement are identified and measures for minimizing these enlargements are presented. This analysis considers only the idealized optical problem and does not consider the pragmatic errors associated with implementation and operation of a heliostat array.

6226 (SAND—77-8011) **Highlights report solar thermal conversion program central power projects.** (Sandia Labs., Albuquerque, N.Mex. (USA)). Mar 1977. Contract EY-76-C-04-0789. 100p. Dep. NTIS, PC A05/MF A01.

Separate abstracts were prepared for thirteen papers. (MHR)

6227 (SAND—77-8011, pp 11-12) **Pending requests for proposals in solar central receiver program.** Hughey, R.W. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

The part of the ERDA program presently underway is mentioned. Future proposals will address the development of low-cost heliostats and an advanced central power system. (MHR)

6228 (SAND—77-8011, pp 23-26) **10-MW central receiver pilot plant projects.** Selvage, C. (Sandia Labs., Livermore, CA). Mar 1977.

In Highlights report solar thermal conversion program central power projects.

The concepts and schedules of parallel contracts awarded to four teams to study the central receiver concept are reviewed briefly. (MHR)

6229 (SAND—77-8011, pp 27-31) **Central receiver collector subsystem design.** Ratcheson, W.I.; Gillette, R.B. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

Boeing is developing a preliminary design for the collector (heliostat) subsystem for a 10 MWe solar pilot plant. The collector subsystem concept, operating with a central receiver installation, is shown. Several heliostat field geometries have been investigated with the aid of a heliostat array simulation computer model. Three heliostats and a drive and control assembly are being tested at a Boeing desert test site in northeast Oregon to provide design data and verification of the preliminary design. An extensive evaluation program is being conducted on the key plastic materials used for the protective enclosure and reflector. (MHR)

6230 (SAND—77-8011, pp 32-47) **Central receiver pilot plant design.** Hallett, R. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

Progress is reported in a re-evaluation of both the commercial and pilot plant system design as well as the receiver, thermal storage, and collector subsystem research experiment tests. (MHR)

6231 (SAND—77-8011, pp 48-57) **Central receiver pilot plant design.** Powell, J.C. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

Progress on the pilot plant baseline design is described and illustrated. Heat storage was changed from latent to sensible. Design and testing are described for collector, heat storage, and steam generator subsystems. (MHR)

6232 (SAND—77-8011, pp 58-70) **Central receiver pilot plant design.** Blake, F.A. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

The following topics are discussed: system design and optimization and progress on collector, receiver, and thermal storage subsystems. (MHR)

6233 (SAND—77-8011, pp 71-76) **5-MW solar thermal test facility.** GrossKreutz, C. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

The ERDA 5-MW Solar Thermal Test Facility is described briefly. Progress to date on the major design/construction packages is shown. A condensed version of the overall design/construction schedule, an artist's rendering of the current facility design, an aerial photograph of the construction site, an artist's rendering of the test tower, and a cross section of the test tower are shown. (MHR)

6234 (SAND—77-8011, pp 77-80) **Solar energy receiver.** Poirier, A. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

A solar receiver/heat exchanger unit for advanced solar powered electric generation plants is described. A reduced power model of this receiver was tested using a solar furnace. The test is described and some results are presented. (MHR)

6235 (SAND—77-8011, pp 81-84) **Heat pipe central solar receiver.** Bienert, W.B. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

A solar-to-gas heat exchanger for a central receiver power plant is discussed. Three potential receiver configurations and typical wick structures for the heat pipes under development are shown. The performance of the tent wick heat pipe is presented. A conceptual design of a test module with a capacity of 1 MWt is sketched. (MHR)

6236 (SAND—77-8011, pp 85-90) **Cavity-type line central receiver.** Slemmons, A. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

A cavity-type line central receiver and parabolic cylinder focusing collector array designed to generate steam for electric power are discussed. Progress to date is mentioned briefly. The system is described and illustrated including the line receiver, the heliostat, the heliostat focus system, the heliostat test, and the heliostat wash vehicle. (MHR)

6237 (SAND—77-8011, pp 91-98) **Liquid metal cooled solar central receiver feasibility study and heliostat field analysis.** Vant-Hull, L.L.; Raetz, J. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

A 100-MWe sodium-cooled, solar central receiver system is being analyzed to define the conceptual design and determine the technical feasibility of the system. Additional work on slope and latitude studies for a water/steam receiver, net energy balance, and insolation are described. (MHR)

6238 (SAND—77-8011, pp 99-100) **1-MW/sub th/ solar cavity steam generator.** Tracey, T.R. Mar 1977.

In Highlights report solar thermal conversion program central power projects.

Experience gained in infrared testing of a cavity-type central receiver is discussed briefly. (MHR)

6239 (SAND—77-8510) **Solar central receiver power plants.** Skinrood, A.C. (Sandia Labs., Livermore, Calif. (USA)). Sep 1977. Contract EY-76-C-04-0789. 21p. (CONF-770944—1). Dep. NTIS, PC A02/MF A01.

From Solar energy workshop; Ashkhabad, USSR (Sep 1977).

Prototype heliostats, receivers, and storage subsystems have been built and tested as a part of the recently completed two year research and development program for solar central receiver system technology. This technology will serve as the basis for the detailed design and construction of a 10-MW pilot plant in Barstow, California, scheduled for operation in 1981. Successful operation could lead to the construction of a demonstration plant in the mid to late 1980s. Progress in understanding the technology necessary for large-scale utilization of solar energy to generate electricity is well under way.

6240 **Survey of selective absorber coatings for solar energy technology.** Melamed, L.; Kaplan, G.M. (ERDA, Washington, DC). *J. Energy;* **1**: No. 2, 100-107(1977).

Solar photothermal electric powerplants are being conceptualized that will produce turbine-generated electricity from fluids heated to high temperatures by concentrated sunlight. A key research objective is to design coatings for the receiver optics that are highly absorbing in the visible out to about two microns but are highly reflecting (therefore have low emittance) beyond two microns. This dual requirement has generated a research program in composite materials coatings. Past accomplishments and promising new materials are described.

6241 **New method for collector field optimization.** Abdel-Monem, M.S.; Hildebrandt, A.F.; Lipps, F.W.; Vant-Hull, L.L. (Univ. of Houston, TX). pp 372-387 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A comprehensive computer simulation program has been used to optimize heliostat locations in a collector field and to compute the fraction of the solar energy which actually strikes the receiver. The new optimization method makes a 10 percent improvement over previous approximations.

TOTAL ENERGY AND HYBRID SYSTEMS

6242 (AI-ERDA—13200) **Commercial applications of solar total energy systems. Second quarterly progress report, August 1, 1976—October 31, 1976.** (Atomics International Div., Canoga Park, Calif. (USA)). 25 Apr 1977. Contract EY-76-C-03-1210. 103p. Dep. NTIS, PC A06/MF A01.

This report investigates the application of the Solar Total Energy System (STES) to the commercial sector (e.g., office buildings, shopping centers, retail stores, etc.) in the United States. Candidate solar thermal and solar photovoltaic concepts are considered for providing on-site electrical power generation as well as thermal energy for both heating and cooling applications. The solar thermal concepts include the use of solar concentrators (distributed or central receiver) for collection of the thermal energy for conversion to electricity by means of a Rankine cycle or Brayton cycle power conversion system. Recoverable waste heat from the power generation process is utilized to help meet the building thermal energy demand. Evaluation methodology is identified to allow ranking and/or selection of the most cost-effective concept for commercial building applications.

6243 (SAND—77-0690) **Solar Total Energy System Test Facility operational phase test plan.** McAllister, K.D.; Thunborg, S. (Sandia Labs., Albuquerque, N.Mex. (USA)). May 1977. Contract EY-76-C-04-0789. 52p. Dep. NTIS, PC A04/MF A01.

The testing which will be performed on the solar-to-electric components of the Solar Total Energy System Test Facility is specified. Objectives are defined and test procedures described.

OCEAN THERMAL GRADIENT POWER PLANTS

6244 (CONF-7409169—) **Second Ocean Thermal Energy Conversion workshop: workshop proceedings.** Harrenstien, H.P. (ed.). (National Science Foundation, Washington, D.C. (USA); Miami Univ., Coral Gables, Fla. (USA). Clean Energy Research Inst.). Apr 1975. 237p. Science Foundation, Washington, DC.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

Separate abstracts were prepared for eighteen papers. The proceedings also include the reports of the five working groups: biofouling; economics; power technology; resource, oceanographic, and environmental aspects of ocean thermal plants; and marine technology, waves, forces, and positioning. (MHR)

6245 (CONF-7409169—, pp 2-13) **Keynote address: ocean thermal energy.** Anderson, J.H. (Sea Solar Power, Inc., York, PA). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The potential benefits of sea solar power are discussed. The basic principles and economics of an ocean thermal gradient power plant are described. (MHR)

6246 (CONF-7409169—, pp 14-21) **National Ocean Thermal Energy Conversion program.** Cohen, R. (Energy Research and Development Administration, Washington, DC). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

A status report on the national Thermal Energy Conversion program is presented. The objectives are listed and the level of funding is mentioned. The proposals received in the two basic categories are touched on briefly. A summary of awards is tabulated. Two concepts are sketched. (MHR)

6247 (CONF-7409169—, pp 23-27) **General design strategy approach to ocean thermal plants.** Zener, C. (Carnegie-Mellon Univ., Pittsburgh). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The design strategy consisting of four distinct stages: block design, component design, integration design, and topological design, is discussed.

6248 (CONF-7409169—, pp 28-54) **Some technology limitations on practical ocean ΔT power plants.** Heronemus, W.E.; McGowan, J.G. (Univ. of Massachusetts, Amherst). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The two main problem areas confronting ocean thermal energy conversion are corrosion and biofouling. The controlling technology problems are summarized. The Mark I and Mark II designs and modifications are described. (MHR)

6249 (CONF-7409169—, pp 55-57) **Progress report on a working model of a closed cycle plant.** Anderson, J.H. (Sea Solar Power, Inc., York, PA). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The status of the working model of a thermal gradient power plant is reviewed. The turbine and heat exchanger have been built. The turbine has been run on water under simulated performance conditions to get an actual performance test with a brake on the turbine efficiency. (MHR)

6250 (CONF-7409169—, pp 58-61) **Research on an engineering evaluation and test program.** Griffin, A. (TRW, Inc., Redondo Beach, CA). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The ground rules, organizational structure, key issues, project schedule, and pertinent information on the TRW contract are presented. No technical results are presented. (MHR)

6251 (CONF-7409169—, pp 67-79) **Nearshore application for an Ocean Thermal Energy Conversion pilot plant in Hawaii.** Bathen, K.H. (Univ. of Hawaii, Manoa). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The objective of the project is to assess potential sites for nearshore ocean thermal proof-of-concept experiments off Keahole Point on the island of Hawaii. The main efforts are an oceanographic evaluation of the Keahole area and a socioeconomic profile of the neighboring Kailua-Kona coast. The oceanographic effort is divided into three phases: a historical data survey, an effort to provide data where existing data were insufficient, and an attempt to estimate potential impact of the pilot plant. The data taken include bathymetric surveys, current meter data, and local water quality to at least the 1,500-foot depth. Some early results of temperature, salinity, and nutrient profile are shown. (MHR)

6252 (CONF-7409169—, pp 80-89) **Progress report of OTEC research at the University of Massachusetts.** McGowan, J.G.; Heronemus, W.E. (Univ. of Massachusetts, Amherst). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

Diagrams of power plant components are shown. A preliminary cost estimate for a 400 MW ocean thermal power plant design is given. Other results are mentioned briefly and conclusions for ocean thermal power systems are presented. (MHR)

6253 (CONF-7409169—, pp 90-99) **Progress report on Solar Sea Power Plants.** Lavi, A. (Carnegie-Mellon Univ., Pittsburgh). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

A general discussion is presented on problems in Ocean Thermal Power Plant design with emphasis on pumps and cold water intake. Some possible component layouts are sketched. (MHR)

6254 (CONF-7409169—, pp 101-125) **Heat exchangers and optimum design for Solar Sea Power Plants.** Lavi, A. (Carnegie-Mellon Univ., Pittsburgh). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The crucial design of the heat exchanger in this case where the ΔT is so low is emphasized. The possibility of creating nucleate boiling to increase the heat transfer coefficient is discussed. The advantages of corrugation in heat exchanger surface are dealt with in detail. (MHR)

6255 (CONF-7409169—, pp 126-145) **Heat exchangers for ocean thermal power plants.** Notaro, F. (Union Carbide, Tonawanda, NY). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The development of enhanced heat transfer surfaces is discussed with emphasis on porous boiling surfaces and fluted profiles on the outside of tubes. Preliminary design parameters of an evaporator for a 110 MW plant are presented. Current heat exchanger design practice is shown. Some preliminary results and conclusions are presented. (MHR)

6256 (CONF-7409169—, pp 146-148) **Development of plastic heat exchangers for sea solar power plants.** Suratt, W.B. (DSS Engineers, Inc., Ft. Lauderdale, FL). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

A few aspects of materials studies and the production of plastic heat exchangers are discussed briefly. (MHR)

6257 (CONF-7409169—, pp 149-158) **Plastic heat exchangers for sea solar plants.** Sieder, E.N. (DSS Engineers, Inc., Ft. Lauderdale, FL). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

A conceptual design of a heat exchanger using plastic heat exchanger tubes $^{3}/_{8}$ inch OD is discussed for the case of forced circulation of warm seawater through enclosed boilers. Design features are tabulated and arrangement sketches are shown. (MHR)

6258 (CONF-7409169—, pp 159-166) **Heat exchangers for sea solar power plants.** King, B. (Univ. of Miami, Coral Gables, FL). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

Obvious problems in the development of heat exchangers for solar sea power plants and some of the more popular solutions to these problems offered so far are summarized. Subjects covered are: modular construction of power plant components, availability of components, maintenance, and the need for some experimental work under realistic ocean conditions. (MHR)

6259 (CONF-7409169—, pp 180-185) **Design against corrosion and biofouling: an ounce of prevention.** Craig, H.L. (Univ. of Miami, Coral Gables, FL). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

Four points involved in marine corrosion and biofouling prevention are discussed: materials selection, quality control testing to make sure the job gets what the engineer selected, surveillance during construction to make sure the materials is put in right, and a maintenance program to insure an operating plant after 20 years. Illustrations from research and experience are touched on for each point. (MHR)

6260 (CONF-7409169—, pp 186-204) **Economic considerations in the case of sea solar power plants.** Naef, F. (Lockheed, Inc., Washington, DC). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The following topics are considered: the resource allocation process, capital costs; operating costs; cost considerations; and the indirect economic factors; political, social, environmental, and technical. (MHR)

6261 (CONF-7409169—, pp 205-206) **Environmental considerations.** Levanthal, E.L. (TRW, Inc., Redondo Beach, CA). Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

The impact of an ocean thermal energy conversion system on the environment is disucssed briefly in the areas: physical, chemical, and biological phenomena. (MHR)

6262 (COO/2642—76/3) **Deep water pipe, pump, and mooring study: ocean thermal energy conversion program. Final report.** Little, T.E.; Marks, J.D.; Wellman, K.H. (Westinghouse Electric Corp., Annapolis, Md. (USA). Oceanic Div.). Jun 1976. Contract EY-76-C-02-2642. 186p. Dep. NTIS, PC A09/MF A01.

The ocean engineering issues affecting the design, construction, deployment and operation of Ocean Thermal Energy Conversion (OTEC) power plants were studied. The problems associated with the conceptual design of the deep-water pipe, cold-water-pumping, and platform mooring arrangements were addressed. These subsystems fall into a natural grouping since the parameters affecting their design are closely related to each other and to the ocean environment. Analysis and evaluations are provided with a view toward judging the impact of the various subsystems on the overall plant concept and to provide an estimate of material and construction cost. Parametric data is provided that describes mooring line configurations, mooring line loads, cold water pipe configurations and cold water pumping schemes. Selected parameters, issues, and evaluation criteria are used to judge the merits of candidate concepts over a range of OTEC plant size from 100 MWe to 1000 MWe net output power.

6263 (COO/2895—7) **System analysis and engineering studies for ocean thermal energy conversion. Final report, January 1, 1976—September 30, 1976.** Lavi, A. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). 15 Nov 1976. Contract EY-76-S-02-2895. 65p. Dep. NTIS, PC A04/MF A01.

The question of tube layout in an OTEC heat exchanger is studied so as to meet a desired performance at a minimum cost. A number of layouts employing vapor lanes (tributaries and main channels) have been evaluated for a large 25 MWe heat exchanger module. There appear to be a number of practical arrangements which result in a low pressure loss without increasing the shell diameter. An attempt is made to develop an analytical model for predicting the transient response of a complete OTEC power cycle. A system of ordinary differential equations and a number of algebraic relationships have been derived which allow the modeling of a variety of transient processes of the system and also lay the foundation for the control strategies necessary to achieve a desired performance. A conceptual design is presented of two OTEC power plants employing vertical, fluted tubes in the heat exchangers. One cycle plant is nominally designed to produce 1 MWe and the other is a self-sustaining system capable of producing all its pumping and parasitic power requirements at the least available seasonal ΔT. A procedure for the design of such small plants is developed which, if desired, can be readily computerized.

6264 (SAN—1156/77/1(Vol.2)(Pt.B)) **Ocean Thermal Energy Converstion (OTEC) test facilities study program. Final report. Volume II. Part B.** (Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif. (USA)). 17 Jan 1977. Contract EY-76-C-03-1156. 271p. (LMSC-D—506781(Vol.2)(Pt.B)). Dep. NTIS, PC A12/MF A01.

Results are presented of an 8-month study to develop alternative non-site-specific OTEC facilities/platform requirements for an integrated OTEC test program which may include land and floating test facilities. Volume II—Appendixes is bound in three parts (A, B, and C) which together comprise a compendium of the most significant detailed data developed during the study. Part B provides an annotated test list and describes component tests and system tests.

6265 (SAN/1156—77/1(Vol.2)(Pt.C)) **Ocean Thermal Energy Conversion (OTEC) test facilities study program. Final report. Volume II. Part C.** (Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif. (USA)). 17 Jan 1977. Contract EY-76-C-03-1156. 264p. (LMSC-D—506781(Vol.2)(Pt.C)). Dep. NTIS, PC A12/MF A01.

Results are presented of an 8-month study to develop alternative non-site-specific OTEC facilities/platform requirements for an integrated OTEC Test Program which may include land and floating test facilities. Volume II—Appendixes is bound in three parts (A, B, and C) which together comprise a compendium of the most significant detailed data developed during the study. Part C describes test facility support, data acquisition and control system design, cost data, energy self-sufficiency, and test facility applications.

6266 (SAN/1156—77/1(Vol.2)(Pt.A)) **Ocean Thermal Energy Conversion (OTEC) test facilities study program. Final report. Volume II. Part A.** (Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif. (USA)). 17 Jan 1977. Contract EY-76-C-03-1156. 260p. Dep. NTIS, PC A12/MF A01.

Results are presented of an 8-month study to develop alternative non-site-specific OTEC facilities/platform requirements for an integrated OTEC Test Program which may include land and floating test facilities. The document, Volume II - Appendixes is bound in three parts (A, B, and C) which together comprise a compendium of the most significant detailed data developed during the study. Part A contains definitions, baseline revisions, test plans, and energy utilization sections.

SOLAR RADIATION UTILIZATION

REFER ALSO TO CITATION(S) 6119, 6129, 6914, 6937

6267 **Heliotechnique and development. Volume I.** Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). 799p. (In French and English). (CONF-7511131—P1).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

Separate abstracts were prepared for each of the 62 included papers. (MOW)

6268 **Heliotechnique and development. Volume II.** Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). 746p. (In English and French). (CONF-7511131—P2).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

Separate abstracts were prepared for each of the 57 included papers. (MOW)

6269 **Two enemies of industrial development of solar energy: simplicity and economy.** Touchais, M. (COMPLES, Marseille). pp 135-143 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Solar energy installations are necessarily expensive. This has led to extravagant research for simplicity and economy. But the true problem of the industrial utilization of solar energy is not posed in these terms. The most adaptable solutions are not generally simple and are independent of the proprietary research on the best investment return. These considerations are developed on the example of solar heating of homes. The necessity for the technician to be occupied first with solar techniques before preoccupying himself with commercialization is stressed.

6270 **Lumiducts for Ecopolis.** Rottier, G. (Univ. of Damascus, Syria). pp 236-246 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper discusses a new concept of urbanism that would optimize the presence of sunlight where and when it is needed. The settlement on which this concept is applied, Ecopolis, would use lumiducts for its lighting needs. This city is described and the principles of lumiducts are presented.

6271 Economic and social impact of solar powered transportation systems. Duda, J.L. (Computer Sciences Corp., Falls Church, VA). pp 558-569 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A methodical approach to the study of the economic and social aspects of the use of solar-generated electric power for transportation purposes is outlined. The potential socioeconomic impacts of solar-powered transportation systems can be far-reaching. The approach is basically that of impact analysis. Impacted industries are identified and quantified as to their net positive or negative effect on the economy. The main danger in such an approach is simply leaving out or misjudging the real effect of the introduction of proposed transportation systems. A sample case is presented for an electric powered public/private conveyance.

6272 Improved use of energy. Hatami, R. (Arya-Mehr Univ. of Tech., Tehran, Iran). pp 596-602 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The world energy economy has been destabilized by the sudden increase in fossil fuel price. This had the beneficial effect of revising the methods of energy consumption and of investigating new energy sources. This paper surveys briefly the different possibilities of energy conservation in buildings and of recuperation of waste from nuclear plants. It also discusses the multi-aspect power plant concept, where heat is used throughout a wide range of temperatures for various processes. This concept combines the use of solar energy with nuclear energy.

SPACE HEATING AND COOLING

REFER ALSO TO CITATION(S) 6123, 6141, 6323, 6356

6273 (AED-Conf—77-027-002) **Construction of buildings in view of utilization of solar energy.** Steiger, P. (Technische Hochschule Darmstadt (Germany, F.R.)). Jan 1977. 14p. (In German). (CONF-770378—2). Dep. NTIS (US Sales Only), PC A02/MF A01.

From 3. meeting of the Deutsche Gesellschaft fuer Sonnenenergie e.V. on heating with sun 2 - house technology under practical aspects; Munich, F.R. Germany (3 Mar 1977).

Problems occurring in the use of solar energy for energy supply in buildings are discussed. It is pointed out that the energy amount available depends on the climate, that the energy valency is low and that radiation can only be utilized locally and in limited time periods. These facts must be taken into consideration when constructing solar houses.

6274 (AED-Conf—77-027-003) **Building regulations, planning of building constructions and housing development areas taking into account the utilization of solar energy.** Bierhals, R.; Schaefer, G.; Weigert, D. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung). 1977. 24p. (In German). (CONF-770378—3). Dep. NTIS (US Sales Only), PC A02/MF A01.

From 3. meeting of the Deutsche Gesellschaft fuer Sonnenenergie e.V. on heating with sun 2 - house technology under practical aspects; Munich, F.R. Germany (3 Mar 1977).

Complete systems for utilizing solar energy both for hot water preparation and for space heating are available in the FRG today. However, solar technology is unlikely to prevail without governmental support since the plants are still too expensive although there is a principal positive attitude towards solar energy. More knowledge of the process of solar energy utilization is necessary both in the field of building laws, and for building enterprises, architects and planners, if this new form of energy is to succeed.

6275 (COO/2628—2) **Solar heating and cooling experiment for a school in Atlanta: construction report.** (Westinghouse Electric Corp., Baltimore, Md. (USA)). 15 Dec 1976. Contract EY-76-C-02-2628. 61p. Dep. NTIS, PC A04/MF A01.

For previous report on design see PB—240611.

The following subjects were discussed: construction subcontracting, the construction process, and the system start-up. The system drawings and sequence of operation are included in appendices. (MHR)

6276 (COO/2868—2) **Evaluation of a residential solar air heating system. Interim progress report, August 1976—May 1977.** Karaki, S. (Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.). May 1977. Contract EY-76-S-02-2868. 10p. Dep. NTIS, PC A03/MF A01.

The comparative performance of Solar House II collectors (air heater) and Solar House I collectors (liquid heater) is presented. In the 1976 comparison year, there is no conclusive evidence that either system provides a greater fraction of the seasonal load. Both systems were designed to provide approximately 75 percent of the annual space and water heating load, and the design targets are reasonably achieved. In February, 1976, the air system provided 65 percent of the total requirement while the liquid system provided 76 percent. In March, based on a few days of data, the performance was substantially the same. In April the air system provided a greater fraction of solar heat to the total need, but the use of the heat was different, more being used for domestic water heating in Solar House I than in Solar House II. The data for 1977 have not yet been fully analyzed for both solar houses and therefore, a complete comparison cannot be made. At this stage in the evaluations, it can be stated that either system can be designed to achieve the target fraction of the total annual heat requirements. (WHK)

6277 (EPRI-ER—475) **Solar heating and cooling of buildings (SHACOB): requirements definition and impact analysis.** Melton, W.C.; Cretcher, C.K. (Aerospace Corp., El Segundo, Calif. (USA)). Feb 1977. 41p. Dep. NTIS, PC A03/MF A01.

The installation of Solar Heating and Cooling of Building (SHACOB) systems usually requires a backup system—often electric—to take some portion of the load on days of low insolation, and to carry the entire load during extended periods of low insolation. The implications of such systems on the economic operation of electric utilities may be significant if a displacement of required generating capacity does not accompany the displacement of revenue resulting from the displacement of energy. The objective of this study is to define SHACOB design concepts which optimize the economic impact for the electric utilities and their customers. In this interim report the work completed in Phase I of this study is summarized and Phase II plans are presented. The emphasis in Phase I has been on establishing a data base and methodology for studying change in utility demand resulting from the penetration of SHACOB systems. Weather and insolation inputs for simulations have been established for locations across the United States. Reference buildings in nine basic categories have been identified, their thermal properties defined according to ASHRAE 90-75 standards, and detailed internal and external load models generated to characterize building thermal performance. The TRNSYS program has been modified to simulate the performancy of both solar and conventional systems, including load management systems featuring nighttime thermal storage. Nine electric utilities are participating in this study to provide utility specific data and guidance for the impact analysis.

6278 (LA-UR—77-1162) **Passive solar heating of buildings.** Balcomb, J.D.; Hedstrom, J.C.; McFarland, R.D. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 20p. (CONF-770598—1). Dep. NTIS, PC A02/MF A01.

From Workshop on solar energy applications; Aspen, Colorado, USA (27 May 1977).

Passive solar heating concepts—in which the thermal energy flow is by natural means—are described according to five general classifications: direct gain, thermal storage wall, solar greenhouses, roof ponds, and convective loops. Examples of each are discussed. Passive test rooms built at Los Alamos are described and results are presented. Mathematical simulation techniques based on thermal network analysis are given together with validation comparisons against test room data. Systems analysis results for 29 climates are presented showing that the concepts should have wide applicability for solar heating.

6279 (LA-UR—77-1555) **Active and passive solar heating of buildings.** Balcomb, J.D. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 13p. (CONF-770732—1). Dep. NTIS, PC A02/MF A01.

From International conference on solar building technology; London, UK (25 Jul 1977).

An overview of both active and passive solar heating approaches for buildings is presented. Passive solar heating concepts—in which the thermal energy flow is by natural means—are described according to five classifications: direct gain, thermal storage wall, solar greenhouses, roof ponds, and convective loops. Results of simulation analyses are presented for a variety of climates. Active systems utilizing both liquid-heating collectors and air-heating collectors are described. Trends in the recent development of solar heating are discussed.

6280 (NBSIR—76-1127) **Evaluating incentives for solar heating. Final report.** Ruegg, R.T. (National Bureau of Standards, Washington, D.C. (USA). Inst. for Applied Technology). Sep 1976. 71p. Bureau of Standards, Washington, DC.

This report provides a life-cycle cost model and a computer program for measuring the dollar impacts of alternative incentives on the private costs of a solar heating system. In addition, it applies the evaluation model in six case examples, for seven selected incentives. The purpose of the report is to assist state and Federal legislators in formulating effective policies for encouraging the widespread use of solar energy systems in buildings. It does this by promoting quantitative assessment of the kinds of incentive programs now being considered for adoption by many state legislatures and by the U. S. Congress. The results of the case examples indicate that the effectiveness of a given incentive program will differ by region, by type of building, and by fuel prices; that in some states the incentive programs now being enacted will not be worth their administrative costs; and that an in-depth assessment of policy implications should be made of the differential impact of incentive programs on residential versus commercial use of solar energy.

6281 (NP—22337) **Basic principles of solar energy system and design.** (Arizona Public Service Co., Phoenix (USA)). 1977. 29p. TIC.

The fundamentals of solar collector design and operation are discussed. Methods for calculating heat requirements and approximate costs for solar-heated hot water, pool heating, space heating and air conditioning in Phoenix, Arizona, are outlined. Also, tips to consider before buying a solar energy system are given. (WHK)

6282 (TID—27630) **Pacific regional solar heating handbook.** (Los Alamos Scientific Lab., N.Mex. (USA)). Nov 1976. Contract W-7405-ENG-36. 125p. Dep. NTIS, PC A06/MF A01.

This handbook is intended as a guide for engineers, architects, and individuals familiar with heating and ventilating applications who wish to design a solar heating system for a residential or small commercial building in the Pacific Coast Region. The climate of the region is discussed by selected cities in terms of the effect of climate on solar heating requirements. The four states covered are California, Oregon, Washington, and Arizona. Presented in detail are the design parameters and performance characteristics of (1) liquid space heating systems of the active type using flat plate collectors, water heat storage, and forced air distribution; (2) active air space heating systems using flat plate collectors, rock-bed storage, and forced air distribution; and (3) domestic hot water heaters of the active type using liquid-cooled flat plate collectors. The analyses are based on hour-by-hour computer simulations using actual weather data from six selected cities. The collector area required for the three types of active systems has been determined as well as the effect of changes in all the design parameters. A simple, empirical, monthly solar-load ratio method for determining collector area is described and results are presented for 13 additional locations within the region. Swimming pool heaters are described briefly, and passive space heating systems are discussed qualitatively in terms of a number of successful designs.

6283 **Development of a mobile solar testing and recording (STAR) system.** Nimmo, B.; Larsen, R. (Florida Technological Univ., Orlando). pp 85-97 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A mobile solar testing and data handling system has been designed and constructed for the purpose of providing field test data on older solar water heating systems. The system described was designed for the determination of performance parameters. This STAR (Solar Testing And Recording) system has environmental and system instrumentation and data handling capability housed within a small mobile trailer. The system records and processes the data automatically allowing for convenient long term data collection under a variety of user and environmental conditions.

6284 **Survey of absorption refrigeration systems.** Swartman, R.K. (Univ. of Western Ontario, Can.). pp 71-82 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Absorption refrigeration systems are reviewed with main emphasis on the intermittent mode. The principle is described, and several experimental results presented. The paper briefly describes the possibility of combining the cooling and the heating modes in a single system.

6285 **Solar-powered refrigeration by intermittent solid absorption systems.** Eggers-Lura, A.; Nielsen, P.B.; Stubkier, B.; Worsoe-Schmidt, P. (International Solar Power Co., Ltd., Soborg, Denmark). pp 83-104 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A survey of the literature on the intermittent solid-absorption refrigeration system is presented with particular reference to the potential use of such systems in solar-powered refrigeration plants. The results of an independent study of various systems are reported, and the preliminary design of a small ice-making plant with a flat-plate solar collector is described. A cost estimate for the plant indicates that solar-powered refrigeration may be economically feasible, especially in areas where other forms of energy are too expensive.

6286 **Natural cooling: results and problems.** Bartoli, B.; Catalanotti, S.; Coluzzi, B.; Cuomo, V.; Silvestrini, V.; Troise, G.; Monza, E. (Univ., Naples). pp 105-124 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Developments in the area of natural radiative cooling are discussed. The principles are presented. The design and operation of two prototypes are described. In the original design, the selective radiator consisted of a polished aluminum sheet coated with a polymeric material. The improved design used selective surfaces with a low emissivity outside the wavelength window of interest. Research areas which may further improve the design are identified.

6287 **Factors affecting the use of solar energy for cooling.** Khalil, K.H.; Sakr, I.A.; Hegazi, A.I. (Cairo Univ.). pp 125-132 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Refrigeration appears to be a logical use of solar energy in tropical zones. This paper describes some of the factors considered in the design of a solar energy refrigeration system in Egypt. Insolation data for Cairo are presented. The storage alternatives are discussed. The experimental set-up of a solar refrigerator is shown.

6288 **Solar-powered housing unit: simulation of solar heating and cooling in Saudi Arabia.** Jones, R.W.; Kremheller, A.; Titze, I.R. (Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia). pp 144-159 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A report is given on the initiation of a project to investigate the feasibility of a solar-powered residence in the Eastern Province of Saudi Arabia. As a first step, the operation of such a house will be simulated by digital computer, concentrating primarily on a system which includes space heating and cooling and a hot water supply for domestic use. The model to be used and the available meteorological data are outlined. Preliminary results are given for a simulation of the cooling system only.

6289 **Combined solar and petroleum energy HVAC system for a commercial building in Dhahran.** Hamilton, R.C.; Lokmanhekim, M.; Nazli, M. (Tracor, Inc., Rockville, MD). pp 160-179 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A preliminary study was made to compare the principal systems combining solar and petroleum energy HVAC system for a well insulated and Sun shaded three story 100,000 square foot building in Dhahran, Saudi Arabia. The prime candidate system is a nocturnal sky radiation cooled covered pond followed by further water chilling by a heat pump driven by a petroleum fuel engine or turbine. The chilled water is stored underground in insulated tanks ready to cool the building the following day.

6290 **Preliminary design data for a solar house in Riyadh, Saudi Arabia.** Sayigh, A.M.; Abdul-Salam, E.M. (Univ. of Riyadh, Saudi Arabia). pp 180-190 of In Heliotechnique and development. Volume

II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Factors affecting the design of a solar house in Riyadh, Saudi Arabia are considered. First, it considers some of the local building materials. Then, air-conditioning systems are evaluated for possible inclusion in the planned house. Also, solar cells are planned for generating electricity.

6291 Heating a building with solar energy and electricity. Spyridonos, A. (Centre d'Etudes Nucleaires Democritos, Attiki, Greece). pp 191-198 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

One method of heating a building by solar energy combined with the consumption of electric energy during the night is proposed. The price of electricity during the night is supposedly very reduced. Electric energy is stockpiled during the night in a water reservoir capable of furnishing during the day the calories necessary for building heat. This system is studied for the winter season in Greece where the duration of the day is approximately ten hours.

6292 Application of solar heat to buildings in Austria. Viehboeck, F.; Braun, P.; Dobrozemsky, R.; Ruedenauer, F.; Panzhauser, E.; Gilli, P. (Vienna Univ. of Tech.). pp 199-209 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

During winter in Austria, heat requirements are very high while incoming solar radiation and available hydroelectrical energy are minimum. However, there is practically no need for cooling houses in summer. Therefore, solar energy is most important for production of warm water during summer and for additional heating during winter. A project at the Institute of Molecular Biology in Salzburg shows that the best economical utilization of solar heat requires an optimal combination of collectors, various heat storage tanks and heat pumps. This paper describes this integrated solar energy installation.

6293 Environmentally designed housing incorporating solar energy. Lawand, T.A. (Brace Research Inst., Quebec). pp 210-235 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Four environmentally designed partially solar heated houses are being built for use by Quebec Indian populations. The paper summarizes the design philosophy of the solar systems which were adapted, and discusses an experimental solar rock wall developed for use under these conditions. The different climatic conditions at the test sites are also listed. The four solar systems are briefly described, three systems are passive and one uses forced air circulation and a separate heat storage system.

6294 Utilization of solar energy for climatizing a greenhouse. Elrimhen, F.; Khalid, J. (Universite d'Alger). pp 381-395 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This study examines the principal elements of an installation to climatize a market garden greenhouse. This includes a fixed greenhouse, solar energy collectors (plane collectors), a water circuit for the accumulation of solar energy in the form of hot water and for the heating of the greenhouse in the absence of the sun, a reservoir for the storage of hot water, and an aeration system for the greenhouse. For all these points, the optimum technical solutions are presented.

6295 Greenhouses oriented to the Sun. Vatansever, A. pp 396-400 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

An improved type of greenhouse which is better adapted to higher latitudes is described. An asymmetric roof transmits more light in winter and reflects more in summer. This solar-oriented greenhouse improves yields by 20 to 30 percent.

6296 Solar heating projects at the Institute for Environmental Research. Braunlich, G.; Frey, K.; Podesser, E. (Institut fuer Umweltforschung, Graz). pp 541-557 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper summarizes projects carried out at the Institute for Environmental Research in Austria. The principal activities deal with solar heating. Design methods for solar collectors are discussed. Four applications are described: tobacco drying, water heating, swimming-pool heating, and solar greenhouses.

6297 Organization chart for the accelerated development of industrial applications of solar energy. Touchais, M. (COMPLES, Marseille). pp 605-608 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

If one refers to the history of technology, it is possible to identify organization elements which would favor innovation in the area of solar technology. The solution of the energy problems is becoming pressing and it can not be abandoned to an evolution governed by chance. An applied research structure and commercialization structure acting by feedback on research itself are proposed. Such structures should have the effect of causing a spectacular acceleration of technological process.

AGRICULTURAL AND INDUSTRIAL PROCESS HEAT

REFER ALSO TO CITATION(S) 6123, 6296, 6310, 6348

6298 (ERDA—77-72) **Solar energy for agriculture and industrial process heat.** (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Solar Energy). Jun 1977. 83p. Dep. NTIS, PC A05/MF A01.

The overall goal of the ERDA plan is to substitute solar heat for fossil-fuel heat wherever possible without intermediate conversion of the heat to electrical energy. Specific objectives are: (A) to develop and demonstrate agricultural solar energy technology which could provide a substantial amount of heat energy required for: (1) food processing, (2) grain drying, (3) crop drying (peanuts, forage, and tobacco), (4) livestock shelter heating, and (5) greenhouse heating; and (B) to apply solar state-of-the-art components and technology to industrial processes so as to demonstrate their capability of supplying a significant amount of the energy requirements of industry. Summaries of ERDA sponsored projects are presented. (WHK)

6299 Decontamination of food stuffs by the use of simple solar utensils. El-Agib, A.A.; Erwa, H.H. (Univ. of Khartoum, Sudan). pp 274-280 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Experiments were conducted at the University of Khartoum to find cheap ways of decontaminating food stuffs with the use of solar energy. The result is a metallic container insulated by straw and leaves of local palm-trees called tabag. Experiments showed that exposure of food stuffs over seventy-five minutes at midday in tabags removes entirely dangerous pathogens.

6300 Powder metallurgy and the need of solar energy. Nazmy, M.Y.; Abdel-Aal, H.K. (Univ. of Petroleum and Minerals, Dhahran, Saudia Arabia). pp 570-575 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Powder metallurgy involves powder production, compaction, and sintering. Solar energy can be used indirectly in reducing the oxide powders. Sintering can be implemented using solar energy as a direct source of heat. Special emphasis is given on the sintering of structural parts made of steel powders, where the required temperature is about 1100°C. A detailed discussion of the prospects of the use of solar energy both directly (heating) and indirectly (reduction) in the forming of metals by the powder metallurgy technique, is presented.

6301 Solar dryer for dehydration of perishable food. Awad, A.H. (Univ. of Nigeria, Nsukka). pp 281-291 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A solar dryer was designed for the dehydration of perishable food. A model crop, yam, was perfectly dehydrated in about four hours, which is almost the same time as with an electrical dryer that consumes 10 kWhr/kg of flour while the method of exposing the crops directly to the Sun takes three or four days. The yam flour produced proved superior to the products of other processes. The solar dryer was also used for coconuts and other crops. Its manufacturing cost is small, and it can be easily constructed.

6302 Improved solar collectors for agricultural drying and industrial processing. Sheppard, A.P.; Schlag, J.G.; Williams, J.R. (Georgia Inst. of Tech., Atlanta). pp 292-299 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper describes non-concentrating and focusing air-heating collectors. Non-focusing collectors can heat air from 10°C to 50°C above ambient. The three types under consideration are: a horizontal collector using blackened gravel as the absorber surface covered by a plastic film; a tilted collector using a black plastic film as the absorber, covered by a transparent film, with air flowing beneath the black plastic; and a collector integrated into the roof of a barn. The tested focusing collector heated air to temperatures in excess of 300°C. It may be used for rapid drying of forage crops and for industrial process heat.

6303 Flat plate collector for solar dryers. Headley, O.; Bryan, V.; Hoogmoed, W. (Univ. of the West Indies, St. Augustine, Trinidad and Tobago). pp 300-306 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A flat plate collector has been designed so that the natural convective air movement leads to large differences in temperature between its ends. Since high temperatures are only obtained at the upper section, the lower section needs less insulation. Under cloudy conditions, temperatures at the upper end are higher than in normal flat plate collectors. This end is fitted with a coolant jacket through which mineral oil is circulated and heat is stored in an insulated oil tank. A larger unit designed with a rock pile for heat storage will be used as a crop dryer.

WATER HEATING

REFER ALSO TO CITATION(S) 6123, 6274, 6281, 6282, 6296

6304 Domestic hot water and solar energy in Ireland. Hand, F.; Asare, B.; Haslett, J. (Trinity Coll., Dublin, Ireland). *Int. J. Energy Res.;* **1**: No. 2, 249-257(1977).

Two systems for using solar energy to supply Ireland's domestic hot-water requirements are examined. The systems are evaluated for their thermal performance and cost-effectiveness using a computer simulation model of a system involving a typical commercially available solar panel. It is shown that, when compared to electricity, such systems may be economically justified only if the water supply is directly heated by solar panels that have a low installation cost. It also appears that the system performance is relatively insensitive to the panel orientation and is unlikely to cause difficulties for retrofit installations on existing houses. 11 references.

6305 Solar water heater using hardened black polythene pipe absorbers. Hamid, Y.H. (Institute of Solar Energy and Related Environmental Research, Khartoum, Sudan). pp 245-250 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A solar collector for which the absorber is made of locally produced polythene pipes is tested for water heating. A system incorporating the collector is suggested to suit the types of buildings, materials used, and conditions of operation in Northern Sudan.

6306 Numerical model for a solar water heater. Sfeir, A.; Menguy, G.; Mujais, S. (American Univ. of Beirut, Lebanon). pp 38-52 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A detailed numerical model for a solar water heater is presented. The model uses a three-node formulation for the collector and a one node formulation for the storage tank. The system is described using four ordinary non-linear differential equations. The solution of these equations is obtained numerically using a fourth order Runge-Kutta algorithm. It is found that the model can give an insight in the operation of a water heater and may be effectively used to optimize such a system.

OTHER

REFER ALSO TO CITATION(S) 6346

6307 Electric energy from atmospheric water vapor. Starr, V.P.; Gaut, N.E. (Massachusetts Inst. of Tech., Cambridge, MA). pp 759-772 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Use of the latent energy of condensing atmospheric water vapor is proposed as a commercial source of power. On the basis of theory, a special type of heat engine is designed to accomplish this purpose.

6308 Thermostatics and thermokinetics of a plane solar furnace with constant calorific value. Flechon, J.; Martin, G.; Wertwijn, R.; Toure, I. (Univ., Nancy-1). pp 213-226 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

It is shown that a plane solar furnace is characterized by a static constant relating the intensity of solar radiation at normal incidence to the equilibrium temperature of the collector. The law is analogous to Stefan's law where the constant is a function of the number of window panes, dimensions of the apparatus, and its insulation in a given supposedly invariable environment. Experiments confirm the theory. The solar furnace is optimized by defining an upper limit for its calorific capacity and defining the number of panes to be used in order to attain an acceptable utilization regime with a sufficient yield.

6309 Organic Rankine Cycle Engine development and solar energy utilization. Ichikawa, S.; Watanabe, M. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyō). pp 739-752 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The Solar-Heat Actuated Organic Rankine-Cycle Engine is one of the most advantageous means of utilizing solar heat, because it is compact and reliable. This paper discusses the development in Japan of such engines snce 1961. In particular, it describes a 490 kW packaged unit, recently commercialized, and a standardized series of 25 kW and 50 kW packaged units. These units could be applied to a large variety of power requirements, such as electrical generation, water pumping, air-conditioning and refrigeration.

6310 Solar energy applications to water pumping and agriculture. Meinel, M.P. (Univ. of Arizona, Tucson). pp 307-314 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Solar energy can provide an alternative in arid regions where irrigation and intensive agriculture are important. A review of past efforts points to the advantages and problems to be surmounted in solar energy utilization. Several low-temperature solar water pumps are currently under evaluation in the Sonora desert. System studies at the University of Arizona indicate that higher temperature solar water pumps may be more cost-effective than the low temperature systems. An adaptation of a collector design originated by Veinberg is described.

6311 Water pumping - a practical application of solar energy. Fiatte, F.; Clemot, M. (Compagnie Francaise des Petroles, Paris). pp 331-339 of In Heliotechnique and development. Volume II. Kettani,

M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper reviews the characteristics and advantages of solar pumping installations. Existing 1 kW and 25 kW stations are described. These stations are integrated with buildings which can be used to house a school, a market or a dispensary.

6312 Overview of solar still greenhouse performance and optimal design studies. Selcuk, M.K.; Tran, V.V. (Jet Propulsion Lab., Pasadena, CA). pp 349-373 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Various schemes and trials for use of solar desalinated water for agricultural purposes are outlined and previous work is summarized. A joint program started in 1971 between the Middle East Technical University of Ankara, Turkey, and the Brace Research Institute of McGill University is outlined. Two years of design and operation experience of the Solar Still Greenhouse combination in Ankara and extended studies on the optimization of the design and operation parameters in Montreal are presented. Structural, plant production and economic aspects are considered in the optimization model. Alternative designs and future research are also recommended.

6313 Review of the present status of solar distillation. Blanco, P. (Comision Nacional de Energias Especiales, Madrid). pp 415-423 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A brief historical review is given and the most important and recent studies on solar distillation are reviewed. The best known types of solar stills and their reliability are analyzed.

6314 Possibilities of demineralization of saline water in Arab countries. Abbas, M.A.; Elnesr, M.K. (Univ. of Baghdad). pp 424-430 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Desalination plants in Arab countries are reviewed. With increasing costs of fuel and power, research has been directed towards the utilization of solar energy in the production of fresh water. Several solar stills have been constructed and experimented. Comparison of the roof-shape still with the L-shape type shows that the latter is more efficient. Experimental results show that these are still economically feasible and can produce water at about 0.6 I.D./m^3.

6315 Chimney and heated-head solar stills. Bartoli, B.; Catalanotti, S.; Coluzzi, B.; Cuomo, V.; Di Palma, R.; Troise, G. (Univ., Naples). pp 431-451 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Two types of solar stills are studied. The first is a chimney system where both heating and vaporization are distributed, whereas condensation occurs in a heat exchanger. The second is a heated-head system in which heating occurs in a solar panel, while vaporization is distributed.

6316 Continuous solar still with distinct heating and condensing partitions. Boldrin, B.; Scalabrin, G. (Univ. Padova). pp 452-457 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

This paper describes a solar still formed by two distinct partitions. The first heats and humidifies air which flows, by the stack effect, in a blackened metallic duct. A counter-current of saline water flows over this duct, and a protective shield is used to prevent convection. Then, air passes by natural draft into the second shaded partition, where most of its humidity condenses on the duct. The protective shield is transparent to the infrared, allowing heat losses by radiation and convection to the environment.

6317 Solar-assisted distillation of sea water. Tleimat, B.W.; Howe, E.D. (Univ. of California, Berkeley). pp 458-482 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The preliminary design of a plant to produce 40 m^3/day of fresh water is given. The plant consists of a 15-effect rotating evaporator, together with the solar collector, water storage tanks, flash tank and various pumps and controls. Steam is condensed on the inside flat surfaces of narrow cylindrical enclosures, and latent heat is used to partially evaporate sea water from thin films on the other faces. The electrical energy required is of the order of 5 kWh/m^3 of water produced. Cost estimates indicate that water could be produced more cheaply by the proposed plant than by basin-type distillers.

6318 R and D program on sea water desalination plants. Schubert, K.P. (Dornier System, Friedrichshafter, Ger.). pp 483-490 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

A brief comparison of two solar desalination systems is presented. The first is a solar still using a high efficiency solar collector separated from the saline water input. The second is a solar powered reverse osmosis system producing both electricity and fresh water. This latter system is limited to the demineralization of brackish water with less than 10,000 ppM salt content.

6319 Sea water desalination by solar refrigeration. Soliman, M.A. (Univ. of Riyadh, Saudi Arabia); El-Difrawi, A.; Abdel-Hameed, M.F. pp 491-499 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Freezing methods for water desalination are considered. A solar refrigeration system using the low temperature heat of flat plate collectors is suggested. The refrigerant is butane, and the absorbent is a suitable light hydrocarbon oil. An economic analysis of this system is presented. Comparison with other methods of desalination shows that the system is favorable for large scale production of fresh water.

6320 Manufacture of block-ice from seawater by solar refrigeration. Mikhail, N.R. pp 500-514 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The manufacture of pure ice from sea water by solar refrigeration competes advantageously on grounds of cost, with the conventional methods. This paper is an interim economic feasibility study justifying the construction of a large prototype plant.

6321 Data on solar desalination for potable water in rural areas. El-Agib, A.A. (Univ. of Khartoum, Sudan). pp 515-521 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The economics of solar desalination may be greatly improved if the tolerance limit of animal and man for water salinity is taken into consideration, and a blending formula is used. A smaller amount of pure water is then needed for mixing with the brackish water, thus minimizing the still areas required. This paper indicates the permissible salinity limits adopted in the Sudan and suggests a simple relation to calculate the blending ratio. It also includes a description of the solar stills developed by the Institute of Solar Energy and Related Environmental Research of the Sudan.

6322 Geothermal energy in Saudi Arabia and its use in connection with solar energy. Otkun, G.; Sayigh, A.M. (Univ. of Riyadh, Saudi Arabia). pp 583-595 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

Geothermal energy could be extracted from hot springs and deep aquifers. This paper presents a survey of the geothermal energy potential of Saudi Arabia. It also discusses the possibility of combining solar and geothermal energy to produce fresh water and electricity.

SOLAR COLLECTORS AND CONCENTRATORS

REFER ALSO TO CITATION(S) 6119, 6124, 6225, 6276, 7007

6323 (AED-Conf—77-027-004) **Liquid heat transfer media for solar systems.** Barthold, K.P. (BASF A.G., Ludwigshafen am Rhein (Germany, F.R.)). 1977. 7p. (In German). (CONF-770378—4). Dep. NTIS (US Sales Only), PC A02/MF A01.

From 3. meeting of the Deutsche Gesellschaft fuer Sonnenenergie e.V. on heating with sun 2 - house technology under practical aspects; Munich, F.R. Germany (3 Mar 1977).

In solar systems, heat transfer media must be used in order to take up the heat on the collector produced by solar radiation and to exchange it after pumping it into the heat reservoir. The most important demands on a heat transfer medium are explained, as well as the heat transfer media in use at the moment. Certain deficiencies are found, however, in all substances. A product developed by the BASF does not show the disadvantages seen previously and is very suitable for use as a heat transfer medium.

6324 (CONF-771120—9) **Experimental evaluation of a fixed collector employing vee-trough concentrator and vacuum tube receivers.** Selcuk, M.K. (Jet Propulsion Lab., Pasadena, Calif. (USA)). 1977. Contract EX-76-A-29-1012. 5p. Dep. NTIS, PC A02/MF A01.

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, Georgia, USA (27 Nov 1977).

A test bed for experimental evaluation of a fixed solar collector which combines an evacuated glass tube solar receiver with a flat plate/black chrome plated copper absorber and an asymmetric vee-trough concentrator was designed and constructed. Earlier predictions of thermal performance were compared with test data acquired for a bare vacuum tube receiver; and receiver tubes with Alzak aluminum, aluminized FEP Teflon film laminated sheet metal and second surface ordinary mirror reflectors. Test results and system economics as well as objectives of an ongoing program to obtain long-term performance data are discussed.

6325 (COO/2934—3) **Study of corrosion and its control in aluminum solar collectors. Progress report, December 1, 1976—February 28, 1977.** Giner, J.; Cocks, F.; Wong, D. (Giner, Inc., Waltham, Mass. (USA)). Apr 1977. Contract EY-76-C-02-2934. 40p. Dep. NTIS, PC A03/MF A01.

The corrosion behavior of aluminum alloys in water/ethylene glycol solutions under solar thermal energy collector operating conditions is being investigatd according to the plan of tasks presented in the first quarterly report. The proposed tasks consist of (I) field study of the existing solar collector systems, (II) laboratory study of the corrosion of 1100 series aluminum under various relevant conditions, (III) corrosion study of other alloy/coolant systems, (IV) determination of an aluminum alloy galvanic series in water/ethylene glycol mixtures, and (V) attempting to develop a method to predict the onset of pits via electrochemical measurement. The linear polarization resistance technique is being used in determining the overall corrosion rate, along with quantitative metallographic analysis of pit formation and growth. Research and progress on the five tasks are reported. (WHR)

6326 (COO/2934—4) **Study of corrosion and its control in aluminum solar collectors. Annual progress report, June 1, 1976—May 31, 1977.** Giner, J.; Cocks, F.H.; Wong, D. (Giner, Inc., Waltham, Mass. (USA)). 1 Jun 1977. Contract EY-76-C-02-2934. 89p. Dep. NTIS, PC A05/MF A01.

The corrosion resistance of aluminum alloys in water/ethylene glycol mixtures has been studied in detail under experimental conditions directly relevant to the operation of existing solar thermal energy collector systems. An aqueous ethylene glycol solution with 35% ethylene glycol by volume was chosen as the typical heat transfer medium throughout the entire program. The scope of this study covers the following range of conditions: (1) four different aluminum alloys (i.e., 99.9%, 1100, 3003 and 3004 series aluminum); (2) 70° to 210°F (~ 20° to 100°C); (3) stagnant solution, laminar and turbulent flow; (4) under N_2 and air; (5) in the presence of contaminants (e.g., Cl^-, Cu^{+2} and Fe^{+3} ions); and (6) effects of ethylene glycol decomposition products. The program has been divided into five tasks: (I) field study of the existing solar collectors, (II) laboratory study of the corrosion of 1100 series aluminum in ethylene glycol/water solutions, (III) laboratory study of other alloy/coolant systems, (IV) determination of an aluminum alloy galvanic series in ethylene glycol/water, and (V) the study of a method of predicting the onset of pits via direct electrochemical measurement. In these experiments the linear polarization resistance technique is used in determining the overall corrosion rate, along with accompanying quantitative metallographic analysis of pit formation and growth. The status of these five tasks are discussed. (WHK)

6327 (SAND—77-1461C) **Survey of mirror-dust interactions.** Berg, R.S. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 17p. (CONF-770953—3). Dep. NTIS, PC A02/MF A01.

From Concentrating solar collector conference; Atlanta, Georgia, USA (26 Sep 1977).

Mirrors for concentrating solar energy collectors must maintain their specular reflectance properties in order to transfer energy to the receiver. When foreign particles fall on a mirror surface, they interfere with imaging properties of the mirror. There are numerous types of particulates, many of which tend to predominate in different geographical regions. The regions with highest solar inputs tend to be desert-like environments, where silica dust dominates. Although silica dust is only one of a class of particulates, all dust materials have similar kinds of properties and effects. Dust interferes with the specular reflectance, both by absorbing and scattering incident light. In order to restore the reflectance, the dust must then be removed from the surface in a way that will not cause surface damage. The development of effective cleaning techniques could be aided by knowledge of the nature of the forces that attract and hold dust on the surface. These forces and ways they can be modified to affect cleaning are discussed.

6328 **Optimum orientation of solar collectors.** Hughes, T.; McMullan, J.T.; Morgan, R.; Murray, R.B. (New Univ. of Ulster, Coleraine, Ireland). *Int. J. Energy Res.;* **1**: No. 2, 143-156(1977).

A simple model of atmospheric absorption and scattering, incorporating only three parameters, has been used to fit meteorological data for direct and diffuse radiation and hours of sunshine at latitude 55 degrees North Longitude 6 degrees West. Using this fit for insulation on a horizontal plane, annual and monthly figures for insulation on an inclined plane have been computed. It is found that the annual insulation is relatively insensitive to orientation for angles of tilt between zero and 60 degrees, but that the optimum tilt is 30.5 degrees. When ground reflection is included, the optimum tilt angle rises steadily to 65 degrees as the ground albedo increases from zero to unity. Optimization for summer and winter operation is also considered, as is the effect of various characteristics of practical collectors. 8 references.

6329 **Contribution to the study of solar energy collectors: selective plates and cells.** Peri, G.; Gallet, P.; Papini, F.; Pasquetti, R. (Univ., Provence, Marseille). pp 155-165 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A scope is presented on the properties of selective surfaces, mainly their optical characteristics. The antiradiative and anticonvective properties of non-loss cells are given and the association of both selective surfaces and non-loss cells is detailed. Then, the influence of the optical properties on the energy balance of a hot flat plate collector is presented, taking into account the received and emitted radiative spectra. Finally, a practical application is described: the thermal efficiency of a solar steam generator is computed versus the incident energy and the running temperature of the apparatus.

6330 **Progress in development and application of selective surfaces.** Meinel, A.B. (Univ. of Arizona, Tucson). pp 166-179 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The attainment of highly selective absorbing and transmitting surfaces opens the question of where they can be effectively used in solar collectors. Decisions on use depend on the cost-benefit ratio of each type: chemical, electrochemical, CVD and vacuum deposited. A review of the characteristics of each type is given. Applications depend on situations where high selectivity provides sufficient benefit. The most favorable ones are in cases of zero or low optical concentrations and of working temperatures in the 150-350°C range. Some applications are also described.

6331 **Thin film solar acceptors.** Burrafato, G.; Giaquinta, G.; Mancini, N.A.; Pennisi, A.; Troia, S.O. (Univ., Catania, Italy). pp 180-187 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Tandem systems are realized using as absorber a film of InSb, a degenerate semiconductor, and a layer of Ag or Al acting as reflector. Heating measurements are performed and compared with analogous measurements performed with conventional systems. Different thicknesses both of the InSb film and metallic layer are tested. To improve the collection efficiency, tandem systems, where the absorber is made up by several layers of InSb of various thickness separated by plastic layers, are also tested. The results are presented and some perspectives in the application of these methods are indicated.

6332 Waveguide high pass filter for thermal conversion of solar energy. Van Wakeren, J.H.A.; Verhoeven, J. (FOM Institute for Atomic and Molecular Physics, Amsterdam). pp 188-193 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A selective surface with large transmission for solar radiation and high reflectance for thermal infrared is discussed. The surface consists of an evaporated metallic layer of 10 microns. In the metallic layer are drilled as many holes as possible. Let each square centimeter contain 10^8 holes with a diameter of 1 micron. A blackbody placed behind this filter receives solar radiation while its own radiation losses are reduced, because of reflection of the infrared on the filter.

6333 Temperature optimization for power production of infinite heat transfer solar absorbers. Cheema, L.S.; Singh, P. (Punjab Agricultural Univ., Ludhiana, India). pp 194-204 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The theoretical aspects of thermal performance of a solar heat absorber are studied. It is found that the ratio of the absorber to the stagnation temperatures completely predicts the thermal performance of collection systems. The result of the analysis is used to obtain the optimum outlet temperature of heat transfer fluid for maximum Carnot efficiency. Simple numerical calculations optimizing the outlet temperature of the transfer fluid are included. The results of the analysis are presented as functions of dimensionless parameters. These are applicable to both concentrating and nonconcentrating collection systems.

6334 Characterization processes for flat solar collectors. Blanchard, C.; Colomes, J.; Lebourg, R.; Ployart, R. (Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). pp 205-212 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The processes used at the Commisseriat a L'Energie Atomique for the characterization of solar collectors contain two steps: determination of the thermal characteristics of the collector under a light flux with known intensity and known spectral distribution and smoothing (adjustment) of a physical calculation code describing this type of collector and then extrapolation to the solar spectrum and to conditions of the natural environment. The solar furnace, measurement processes, and the smoothing method for the calculation are described. The extrapolation to the solar flux for different value of incident flux makes it possible to determine, in addition to the principal characteristics, the yield optimum as a function of the flux and the temperature of the fluid.

6335 Termosole flat plate collectors. Coffari, E. (Termosole, srl, Rome). pp 227-232 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Technical data on a special design of flat plate collectors are presented.

6336 Performance of an annular cylindrical solar collector. Lobo, P.C.; Kluppel, R.P.; de Araujo, S.R. (Cidade Univ., Joao Pessoa, Brazil). pp 233-244 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A digital computer simulation is used to predict the performance of an annular spaced cylindrical solar collector. The device consists of a transparent glass tube, mirrored over part of its circumference, surrounding the absorber tube. Two cases are considered: first, the annular space is evacuated; and second, it is filled with air. The calculation is carried out for various maximum insolation rates and external convective coefficients.

6337 Solergy collector concept. Smith, R.H. (Solergy, Inc., San Francisco). pp 251-264 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A new concept of solar collector is presented. It consists of a non-moving reflective surface using the properties of an Archimedes Spiral. This collector is described and its performance is compared to that of a flat-plate collector using the same material.

6338 Design and fabrication of solar concentrators. Sakurai, T. (Tohuku Univ., Sendai). pp 267-291 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A survey is given of the work done on the design and fabrication of solar concentrators. The fabrication of paraboloidal mirror segments for a 70 kW solar furnace is described together with an improved method of generating a toroidal surface. Economical but less accurate methods of fabrication are also given. Finally, a preliminary study of a large concentrator composed of mirror segments and a Sun-following device is introduced.

6339 Captation and concentration of solar energy. Kleinwaechter, H. pp 292-300 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Various methods of solar energy concentration are presented depending on the level of concentration desired. Special concentrators studied include pyramidal geometries. Special consideration is given to a satellite collecting system made up of several units orbiting in an asynchronous path around the earth. Each satellite is constituted by an icosahedron frame supporting microwave-controlled mirrors.

6340 Inflatable solar concentrator for a high temperature storage system. Taylor, C.S. (European Center for Nuclear Research (CERN), Geneva). pp 301-313 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The optical problems of high concentration solar collectors are discussed. The design of an inflatable parabolic membrane mirror is presented. The material cost for such a mirror would be less than $1 per square meter for a lifetime of several years. This mirror is part of a system designed to produce heat at 750°C to be stored by fluoride eutectics.

6341 Performance of two fixed-mirror solar concentrators for process heat. Kreider, J.F.; Winston, R. (Environmental Consulting Services, Inc., Boulder, CO). pp 314-324 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

Within the past two years two new concentrators capable of process steam production and not requiring diurnal tracking of the Sun were developed. The first consists of a fixed segment of a spherical mirror and a small cylindrical absorber which moves in a planar motion to track the Sun: it is referred to as the Stationary Reflector/Tracking Absorber (SRTA) concentrator. The second, the Compound Parabolic Concentrator (CPS), is capable of collecting some diffuse radiation. Both collectors are analyzed theoretically and their test data are presented.

6342 Effect of decentering on the concentration of a cylindrical-parabolic mirror. Savornin, J. (Univ., Nice). pp 325-328 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P1.
A study is made to determine with what precision a cylindrical-parabolic mirror should be oriented in order to heat a tube placed in its hearth.

6343 Solar energy concentrators using double reflection of the radiation. Cortes, H. (Institut National des Sciences Appliquees, Rennes, France). pp 329-337 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976). (In French)
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P1.
This study is essentially concentrated on the calculation of focussing reflectors for the solar radiation sent by a mirror in the form of a sphere or a circular torus.

6344 Periodically adjustable concentrators adapted to solar cell panels. Durand, H.; Michel, J.; Hunzinger, J.J.; Hily, C. (Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes, France). pp 338-358 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P1.
Specifications of stationary East-West concentrators for solar cells are drawn. The geometrical gain of simple trapezoidal grooves is studied, and the practical yearly average gain is calculated for various configurations. Effects of tilting, reflection coefficient, and diffused light are examined. A monthly adjustable system is a good compromise, giving yearly gains between 2 and 3 depending on conditions. With current prices of solar panels, such a system brings a saving up to 50% of solar electrical energy cost.

6345 Stationary solar concentrators for industrial heating and cooling. Szulmayer, W. (Univ. of New South Wales, Kensington, Australia). pp 359-364 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P1.
A fixed-position linear concentrator suitable for industrial use is described. A refractor strip acts as a cylindrical lens, focussing radition onto a straight pipe. Suitable design can ensure focussing at oblique angles of radiation incidence. Altitude focussing is more critical, as angular deviations shift the focal line away from the target. To correct these deviations, a reflector channel is joined to the flat refractor strip. This linear concentrator can operate continuously without Sun-tracking. Arrangements of the concentrators for industrial purposes, are discussed, together with heat extraction rates at temperatures in the 90 to 130°C range.

6346 Concentration of energy by low cost flat mirror paraboloid. Anwar, M.M. (Pinstech, Nilore, Rawalpindi, Pakistan). pp 365-371 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P1.
To develop a solar powered small irrigation pump a paraboloid mirror had to be constructed with limited funds. Calculations for a 2 hp system on 5% net efficiency showed that a paraboloid concentrator of 400 sq. ft. would be needed, but its estimated cost exceeded the allowed budget. Estimating a temperature of about 400°C for the boiler face, 380 flat mirrors were mounted on a paraboloid structure. With a reflecting area of 258 sq. ft. only, the desired results were obtained. Fabrication of the concentrator and its results are described.

6347 Cylindrical mirror collector field. Smith, R.H. (Solergy, Inc., San Francisco). pp 388-395 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P1.
An improved design for a solar collector is described. This design uses a cylindrical mirror field and a Solergy receiver to obtain concentration ratios over 40. This system is compared with the solar tower and it is found that it could achieve similar performances with lower cost and higher reliability.

6348 Hydrodynamic and heat transfer characteristics of a heated air duct. Malik, M.A.S.; Buelow, F.H. (Solar Energy Program, Karachi, Pakistan). pp 3-30 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P2.
The problem of studying hydrodynamic and heat transfer characteristics in solar air ducts is unique and generally not well-defined. In this paper an extensive survey of the literature is presented which covers various aspects of turbulent flow in air ducts. The information is also useful for design of solar water heaters and solar steam cookers.

6349 Heat transfer in a solar heated air duct: a simplified analysis. Malik, M.A.S.; Buelow, F.H. (Solar Energy Program, Karachi, Pakistan). pp 31-37 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P2.
The output of a solar air heater is determined primarily by its air duct. The latter is covered by a blackened absorber plate which intercepts a uniform solar flux with the other three sides being essentially adiabatic. The flow is generally turbulent and fully developed for most of the duct length, and the duct is hydro-dynamically rough. A simplified mathematical analysis is developed in this paper which predicts the output of an asymmetrically heated duct. The analytical expressions are simple and predict easily the output of a solar air heater.

6350 Efficiency tests on a linear parabolic concentrator for medium and high temperatures. Barra, O.; Conti, M.; Di Stefano, L.; Santamato, E.; Scarmozzino, R.; Visentin, R. (Univ., Calabria, Cosenza, Italy). pp 53-61 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P2.
The performance of a 20 m^2 parabolic cylindrical mirror is described with reference to the optical properties (concentration ratio, reflection efficiency), to the thermodynamic properties (efficiency obtained in the conversion of solar energy into heat at temperatures in the range 100 to 350°C) and with reference to applications to a desalting cycle or to the production of mechanical energy.

6351 Selection of optimal pan color for solar water heater. Abdallah, Y.; Gourgi, I. (Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia). pp 62-67 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).
From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).
See CONF-7511131—P2.
The effect of color on heat absorption is studied. Four pans made out of galvanized steel were used in these experiments. One was painted black, the second white, the third gray, and the fourth was left unpainted. In the first group of experiments the four pans were tested for their performance. In the second, brass shavings were placed in the white pan and iron shavings in the unpainted pan. In all experiments water temperature was measured at various times of the day. The gray pan was found to yield the best results.

HEAT STORAGE

6352 (COO/2591—76/1) Technical and economic feasibility of thermal storage. Final report. Shelpuk, B.; Joy, P.; Crouthamel, M. (RCA Advanced Technology Labs., Camden, N.J. (USA)). Jun 1977. Contract EY-76-C-02-2591. 118p. Dep. NTIS, PC A06/MF A01.
The technical and economic feasibility of various thermal energy storage alternatives is determined by comparing the system performance and annualized cost which result from each storage alternative operating with the same solar collector model, the same building load model, and the same heating system and controls model. Performance and cost calculations are made on the basis of an hour-by-hour time step using actual weather bureau data for Albuquerque, N. M., and New York City for a single six-month heating season. The primary approach to comparing various storage alternatives is to allow the collector area and storage mass to vary until a minimum cost combination is achieved. In the Albuquerque location collector area of 325 ft^2, water storage mass of 12.5 lb/ft^2 of collector area, and phase change mass of 6.25 lb/ft^2 of collector area results in minimum cost systems, each of which delivers about 50% of the total building demand. The primary conclusion is that, using

current costs for materials and containers, water is the cheapest storage alternative for heating applications in both Albuquerque and New York City. The cost of containing or encapsulating phase change materials, coupled with their small system performance advantage, is the main reason for this conclusion. The use of desiccant materials for thermal storage is considered to be impractical due to irreversibilities in thermal cycling.

6353 (COO/2845—77/1) **Two component thermal storage material study, Phase 2. Interim progress report, June 1976—December 1976.** Mehalick, E.M.; Tweedie, A.T. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). Mar 1977. Contract EY-76-C-02-2845. 32p. Dep. NTIS, PC A03/MF A01.

A thermal storage medium of microsized capsules of a phase change material in a fluid offers the advantages of high heat capacity per unit volume and high rate of heat transfer to the phase change material. Several samples of Sunoco's P116 wax were encapsulated in particle size of 500 to 1000 μ. These samples were subjected to an accelerated simulated solar system environment of temperature cycling through the melting temperature of the wax. The wall durability under the stresses due to the volume change of the wax as it changes phase were evaluated and a capsule identified for additional application studies. A packed bed approach to utilizing the capsules in a solar heating and cooling system is being evaluated. A laboratory scale packed bed test assembly was designed and constructed for the experimental evaluation. The packed bed design will be enlarged for full scale tests on a mobile home solar heating and cooling system.

6354 (PB—258738) **Solar energy subsystems employing isothermal heat sink materials. Final project report, September 18, 1974—March 18, 1976.** Lane, G.A.; Best, J.S.; Clarke, E.C.; Glew, D.N.; Karris, G.C.; Quigley, S.W.; Rossow, H.E. (Dow Chemical Co., Midland, Mich. (USA)). Mar 1976. Contract NSF-C906. 61p. (NSF/RANN/SE/C—906/FR/76/1). Dep. NTIS, PC A04/MF A01.

A group of over 200 potential phase change heat storage materials melting from 10 to 90°C was identified. Laboratory tests narrowed these to materials recommended for hot faucet water, hydronic heating, forced air heating, heat pump application, radiant wall panels, and stored cold systems. Several encapsulation methods were studied: microencapsulation, encapsulation of powders and granules, and macroencapsulation. Microencapsulation of $CaCl_2 \cdot 6H_2O$ in polyester resin has been successful, and small wall, floor, and ceiling panels have been prepared and tested. Macroencapsulation in plastic film containers appears promising for hot air systems. Preliminary economic analysis studies of heating systems based on heat-of-fusion storage materials have shown several promising approaches.

6355 **Design and performance of thermal storage water tank.** Nakajima, Y. (Kogakuin Univ., Japan). pp 499-511 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

The dynamic property and the design of the thermal storage tank are presented, and the relationship between the dynamic property of the tank and the performance of solar collectors is explained. The dynamic property of the thermal storage system is expressed as a transfer function, and its analysis is based on experimental results. Practical design methods for suitable dynamic performance in the storage tank are developed, and the relationship between the temperature response coefficient and the efficiency of the solar collector is described.

6356 **Solar and wind induced internal and external coefficients from greenhouses.** Iqbal, M. (Univ. of British Columbia, Vancouver, Can.). pp 374-380 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The solar heat induced free-convective coefficient of an individual leaf within a canopy in a greenhouse and the external forced-convective coefficient from the outer surface of a greenhouse cover to the atmosphere are experimentally determined. To generate free-convective air-flow patterns inside canopies, leaves are simulated by small electric bulbs. A thin metal plate simulating a leaf surface is employed to determine the actual heat transfer coefficient. The external forced-convective coefficient is determined by simulating a greenhouse under an artificially created earth's boundary-layer in an atmospheric wind-tunnel.

GEOTHERMAL ENERGY

REFER ALSO TO CITATION(S) 6420, 6894

6357 **Geothermal: state of the art.** Davis, CA; Geothermal Resources Council (1977). 315p. (CONF-770569—). .

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

One hundred and five papers are included, one of which was processed previously. Separate abstracts were prepared for the 104 papers for Energy Research Abstracts; 6 of the abstracts were selected for Energy Abstracts for Policy Analysis (EAPA). (MHR)

6358 **Geothermal cost and progress scheduling and control.** Robinson, R.F. pp 261-263 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

An important facet of a geothermal field development is the planning and control of the numerous physical activities and financial resources. A Cost and Progress Scheduling and Control System was developed and installed for a two-year overseas geothermal development program which will result in 100,000 KW of power with approximately $2\frac{1}{2}$ million pounds of deliverable steam available from 25 producing wells.

6359 **National geothermal information resource as part of the information transfer cycle.** Strisower, B. (Univ. of California, Berkeley). pp 283-284 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The information transfer cycle is diagrammed and discussed briefly. (MHR)

6360 **LBL geothermal fluid data compilation project.** Cosner, S.R.; Apps, J.A. (Univ. of California, Berkeley). pp 59 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Data on geothermal fluids from the principal geothermal resources in the United States are being compiled at the Lawrence Berkeley Laboratory. The data collected are stored on a computer system to facilitate selective retrieval and manipulation. Printed copies of the compilation will be available with documentation from the laboratory as report LBL-5926.

RESOURCE STATUS AND ASSESSMENT

6361 (CONF-7511133—, pp 96-105) **Development of the nation's geothermal resources.** Kruger, P. 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

The paradox of a vast potential geothermal resource base in the U.S. and negligible current utilization is discussed in general terms. A range of published forecasts for the year 1985 and the equivalent potential in number of 1000 MWe power plants and in oil consumption in millions of barrels per day are given. Problem areas in the development of the geothermal energy cycle are listed. Geothermal exploration methods and environmental impacts of geothermal power production are listed. Institutional and legal aspects are mentioned. (MHR)

6362 **Resource temperature as a measure of geothermal potential.** McFarland, C.B. Jr. (Energy Research and Development Administration, Washington, DC). pp 215-216 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The economic potential of a geothermal resource is a function of many variables but is frequently, and sometimes erroneously, judged according to reservoir temperature. Quantitative computations of ideal work as a function of flow rate, resource temperature, condensing temperature and reinjection temperature show that well productivity (flow rate) and condensing temperature variations within the typical ranges of geothermal resources can be more important economic discriminators than resource temperature. Both thermodynamics and economics dictate advantages for low condensing temperature whereas the effects oppose with regard to reinjec-

tion temperature. Reinjection temperatures greater than 160°F will typically constitute the economically preferred value.

6363 GEOTHERM data file. Swanson, J.R. (Geological Survey, Reston, VA). pp 285 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The basic facts about the data file are reviewed briefly. (MHR)

USA

6364 (EPRI-ER—382) Utilization of U.S. geothermal resources. Final report. Reitzel, J. (TRW Systems and Energy Group, Redondo Beach, Calif. (USA)). Dec 1976. 104p. Dep. NTIS, PC A06/MF A01.

This study is concerned with U.S. geothermal resources, their potential for commercial utilization by electric utilities between now and the year 2000, and their impact on the utility industry. USGS estimates of the resources in identified hydrothermal systems were extrapolated to the undiscovered resources marked by hot springs, and further to the blind resources between hot spring areas within the tectonic belts. The resulting estimate of the total hydrothermal resource to a depth of 10,000 ft. is about 100,000 MWe for 30 years with about one-half in undiscovered blind resources, one-fourth in undiscovered hot spring resources, and one-fourth in identified systems. Water rates and direct capital costs for geothermal power plants were evaluated as functions of resource temperature, together with costs and expected flowrates for geothermal wells. Combining these results with the temperature distribution of identified hydrothermal systems, a current supply curve for geothermal energy was made. This shows an estimated 20,000 MWe for 30 years potentially producible with current technology from identified resources for direct capital costs of $800/KW or less. The projected supply curve shows an estimated 30,000 to 60,000 MWe for 30 years potentially available at $800/KW or less, in 1976 dollars, taking account of estimated undiscovered resources and probable technical advances.

6365 (ERDA—77-74) Hot dry rock geothermal energy: status of exploration and assessment. Report No. 1 of the hot dry rock assessment panel. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Geothermal Energy). Jun 1977. 219p. Dep. NTIS, PC A10/MF A01.

The status of knowledge of attempts to utilize hot dry rock (HDR) geothermal energy is summarized. It contains (1) descriptions or case histories of the ERDA-funded projects at Marysville, MT, Fenton Hill, NM, and Coso Hot Springs, CA; (2) a review of the status of existing techniques available for exploration and delineation of HDR; (3) descriptions of other potential HDR sites; (4) definitions of the probable types of HDR resource localities; and (5) an estimate of the magnitude of the HDR resource base in the conterminous United States. The scope is limited to that part of HDR resource assessment related to the determination of the extent and character of HDR, with emphasis on the igneous-related type. It is estimated that approximately 74 Q (1 Q = 1,000 Quads) of heat is stored in these sites within the conterminous U.S. at depths less than 10 km and temperatures above 150°C, the minimum for power generation. ($Q = 10^{18}$ BTU $= 10^{21}$ J; the total U.S. consumption for 1972 was approximately 0.07 Q). Approximately 6300 Q are stored in the conduction-dominated parts of the crust in the western U.S. (23% of the total surface area), again at depths less than 10 km and temperatures above 150°C. Nearly 10,000 Q are believed to be contained in crustal rocks underlying the entire conterminous U.S., at temperatures above 150°C. The resource base is significantly larger for lower grade heat. (JGB)

6366 Greider testimony to California state geothermal task force. Greider, B. *Geotherm. Energy Mag.;* **5**: No. 10, 16-29(Oct 1977).

The testimony is primarily concerned with resources and reservoir assessment and environmental protection technology. Information on KGRAs in California is given. Near-term electrical and non-electrical potential of California's geothermal resource areas is discussed. The present state-of-the-art of geothermal exploration techniques is described. These techniques include resistivity, gravity, seismic refraction and reflection, telluric and magnetotellurics methods, acoustic, magnetic, microseismicity, remote sensing, heat flow measurement, geochemical analysis, self-potential surveys, and geologic investigations Restrictions on development of geothermal resources because of institutional and environmental requirements are discussed. Measures for protection of the environment from hydrogen sulfide emissions, noise, subsidence, geologic and seismic hazards, etc. are described. Procedures currently in use to limit the amount of surface area required for geothermal exporation and development activities are discussed. (JGB)

6367 Geothermal resources as an alternative for an area with an energy problem: the Rio Grande region. Kleeman, W.T. (Southwest Texas State Univ., San Marcos); Savage, V.H. pp 169-171 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The need for energy in the Rio Grande region is mentioned. The possibility of finding geothermal resources in this area is discussed. A map of the area and the projected electricity demand are shown. (MHR)

6368 Utility industry estimates of geothermal electricity generating capacity. Kruger, P.; Roberts, V. (Electric Power Research Inst., Palo Alto, CA). pp 173-175 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The potential for geothermal electrical energy has been forecast by many universities, consulting firms, professional societies, government agencies, and the resource industries. A major omission is the customer, collectively the electric power utility industry. Two types of data are available: (1) formal forecasts of future year generating capacity filed with the public utility commissions, and (2) informal estimates by individual utilities. Data presented in utility biennial forecasts (for adverse hydro conditions) and in the 10-year coordinated plan summary of the Western System Coordinating Council, indicate a very moderate growth in geothermal electric energy generating capacity from the current value of 502 MW to about 3860 MW in 1995. Informal utility estimates indicate a greater potential, depending on technical and regulatory developments.

6369 Growth in utilization of hydrothermal geothermal resources. La Mori, P.N. (Electric Power Research Inst., Palo Alto, CA). pp 181-182 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Previous estimates of the growth of geothermal electric power production are examined and it is found that all but the most conservative are too high for 1985. The present estimate for 1985 is less than 4000 MWe installed. The previous high estimates were all based on a significant increase in the growth rate of geothermal generation capability, usually occurring in the late 1970s. The present information shows the past rate of installing generating capacity and its estimated growth to 1985 to be at the rate of 10x every 10 years. This is a large growth rate and should it continue to 1990, the installed MWe will be 10,000. The introduction in utilization of water-dominated systems in the early 1980s is necessary for this achievement. The introduction of power generation from geopressure and hot dry rock resources, or the discovery of significant new hydrothermal resources, is necessary for continued high growth beyond 1990.

6370 Geothermal reservoir confirmation requirements and the need for Federal initiatives. Salisbury, J.W.; Williams, D.L.; Nichols, C.R. (Energy Research and Development Administration, Washington, DC). pp 271-273 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

What appears to be a modest goal of 3000 to 4000 MW(e) of geothermal power on line by 1985 requires a surprisingly large exploratory drilling effort by industry to confirm the necessary number of reservoirs. Several different Federal initiatives are discussed that may assist industry in meeting this near-term goal.

6371 Geothermal development in Imperial County. Edmunds, S.W. (Univ. of California, Riverside). pp 81-83 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Imperial County is estimated to have a potential geothermal energy resource of 10,000 to 20,000 megawatts of electricity, of which 4,500 MW appears feasible for development with present technology in the next forty years. Imperial County contracted with UCR and Cal Tech for research covering the areas of: (a) resource assessment, (b) engineering, (c) geography, (d) social, (e) economic, and (f) political and legal implications of geothermal development. These findings are summarized.

GEOLOGY, HYDROLOGY, AND GEOTHERMAL SYSTEMS

6372 Petrology as a practical tool in geothermal studies. Elders, W.A. (Univ. of California, Riverside). pp 85-87 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Petrological studies of subsurface samples are useful and cost-effective in helping to determine the geology and hydrology of geothermal fields. Specific hydrothermal minerals form in response to water/rock reactions at elevated temperatures. The equilibrium assemblages of minerals are known for a wide range of natural conditions of temperature, salinity and fluid pressure. The degree to which equilibrium is attained in a given goethermal reservoir is a function of age, effective permeability and the rates of change of temperature and water chemistry. Permeability varies during the life of a geothermal system due to leaching and precipitation of minerals and because of faulting and hydraulic fracturing. Examples drawn from recent studies in New Zealand and California illustrate how sequences of minerals preserve a record in the reservoir rocks of successive episodes of water/rock reaction and changes in permeability. These studies have obvious applications to resource assessment and managment.

6373 Applications of solute equilibrium models to the study of geothermal reservoirs. Hoagland, J.R. (Univ. of California, Riverside). pp 143-145 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Some applications of equilibrium modelling to geothermal systems are illustrated and underlying problems which must receive adequate attention during exploration and development if the method is to be employed are discussed.

USA

REFER ALSO TO CITATION(S) 6390, 6451

6374 (UCRL—52267) Geologic characteristics of a portion of the Salton Sea geothermal field. Tewhey, J.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Apr 1977. Contract W-7405-ENG-48. 57p. Dep. NTIS, PC A04/MF A01.

The examination of drill cuttings and core samples from the Magmamax Nos. 2 and 3 and Woolsey No. 1 wells indicate that the sequence of sedimentary rocks in the Salton Sea geothermal field from the surface to below 4000 ft can be divided into three categories: cap rock, unaltered reservoir rocks, and hydrothermally altered reservoir rocks. The cap rock extends from the surface to a depth of approximately 1100 ft in all three wells. There is evidence to suggest that the cap rock has undergone self-sealing through time as a result of the circulation of hot brine through the rocks. Essentially unaltered reservoir rocks extend from a depth of 1100 ft to approximately 3000 ft. The mineralogical and textural changes that occur at depth can be attributed to the process of hydrothermal alteration. Alteration has occurred in a chemically open system and the important variables in the alteration scheme have been temperature, permeability, brine composition, and rock composition. The transition from unaltered to altered reservoir rocks is marked by the replacement of calcite by epidote. The first appearance of epidote correlates reasonably well with the top of the alteration zone as determined in other studies by electric log analysis. Biotite and chlorite, potential indicators of alteration zones, are considered to be of detrital origin rather than hydrothermal origin. The primary effect of hydrothermal alteration on the reservoir rocks in the Salton Sea geothermal field has been the reduction of porosity and permeability with depth. Petrographic analysis indicates that porosity and permeability in the field is enhanced by the presence of fractures in shales. The geologic picture that emerges from spontaneous potential (SP) log correlation is that of a structural basin whose axis lies to the northwest of Magmamax No. 2. The data suggest that unaltered reservoir rocks on the periphery of the field offer good production possibilities.

6375 (USGS—1005, pp 123-127) Lithium in the Gila Conglomerate, southwestern New Mexico. Tourtelot, E.B.; Meier, A.L. 1976.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

In Lithium resources and requirements by the year 2000.

Reconnaissance sampling of the Gila Conglomerate of Pliocene and Pleistocene age in southwestern New Mexico revealed anomalously high lithium values in lake beds within the Gila Conglomerate. The lithium is probably derived from the volcanic rocks of the Mogollon-Datil volcanic province by postvolcanic hydrothermal activity associated with hot springs. The alkaline lake environment in which the lake beds were deposited was a sink for the elements added to surface waters by hot-spring activity. Although no deposits of economic potential were found, the geochemistry of the area suggests that beds of hectorite could occur within the lake bed sediments of the Gila Conglomerate.

6376 Geothermal tetonics of the Imperial Valley as deduced from earthquake occurrence data. McEuen, R.B. (San Diego State Univ., CA); Mase, C.W.; Loomis, W.E. pp 211-213 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

An analysis of spatial and temporal change in the mode of earthquake occurrence allows identification of regions where episodes of tensional strain release have occurred. Temporal analysis of the coefficients in the recurrence relation log (NC) = a-b (MAG) is required because in regions like the Imperial Valley the average values of the coefficients in this equation are dominated by events involved with the release of regionally accumulating shear strain. The spatial distribution of this average b coefficient can only indicate major structural provinces. We have conducted a detailed temporal decomposition for two areas, one centered on the presumed region of spreading at the southern end of the Salton Sea and one centered approximately on the Heber geothermal anomaly. It is concluded based on b coefficient temporal change that the events of Oct. 27, 1963 located at the Niland geothermal anomaly involved tensional strain release.

6377 Imperial Valley fault compilation. Teilman, M.; Weiss, R.B.; Meidav, T. (Geonomics, Inc., Berkeley, CA). pp 289-290 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A detailed compilation of faults in the Imperial Valley, California has been prepared as part of a study to assess environmental effects of geothermal development. This compilation concentrates on the sedimentary areas of the valley and synthesizes information from many published and previously unpublished sources onto a 1:250,000 scale map and a corresponding table. The table is keyed to the map and references for each fault location, discrepant location, most recent movement, and evidence of faulting are included. The resulting map gives a graphic display of the complexity of faulting in the valley and supports the implication that more detailed fault studies in Imperial Valley would reveal many more concealed fault traces.

6378 Geologic characteristics of a portion of the Salton Sea geothermal field. Tewhey, J.D (Lawrence Livermore Lab., CA). pp 291-293 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Petrographic analysis of drill cutting samples from the Magmamax Nos. 2 and 3 and Woolsey No. 1 well in the Salton Sea Geothermal Field has resulted in the categorization of the sedimentary sequence. The cap rock extends to 325 m and unaltered reservoir rocks occur to approximately 900 m. The lowermost sequence is hydrothermally altered reservoir rocks. Laboratory measurements of core samples indicate a reduction in porosity with depth and fracture porosity appears to contribute to the total porosity of the system. The geologic picture that emerges from SP log correlation is that of a structural basin whose axis lies to the northwest of Magmamax No. 2.

6379 Geochemical-hydrological studies of the Imperial Valley, California. Weiss, R.B.; Oldknow, T.S.; Meidav, T. (Geonomics, Inc., Berkeley, CA). pp 305-307 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

See CONF-770569.

Water quality data for 145 wells in the Imperial Valley, California were compiled and plotted in three depth intervals, using modified stiff diagrams, Langelier-Ludwig diagrams, single chemical parameter contours and three-dimensional surface plots of the contoured surfaces. The depth zones, chosen from a plot of well perforation intervals, are shallow, from 80 to 300 ft., intermediate, from 300 to 1500 ft., and deep, greater than 15000 ft. The modified Stiff diagrams show the areal distribution of at least five distinct water types, a sodium chloride water, a sodium chloride with high sulfate water, a sodium chloride with high calcium water, a high sulfate water and a sodium bicarbonate water. The Langelier-Ludwig plot shows two distinct groupings. One group essentially along the Na + K axis contains a high proportion of points plotted for the shallow depth zone and the other group, essentially along the

SO_4 + Cl axis, contains a high proportion of points plotted for the intermediate depth zone. Some structural features can be seen on the parameter contour plots.

6380 Interpretation of geothermal gradient and heat flow data for basin and range geothermal systems. Blackwell, D.D. (Southern Methodist Univ., Dallas); Chapman, D.S. pp 19-20 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Simple conceptual models have been developed to explain the nature of many geothermal systems in the Basin and Range physiographic province. Models are characterized by range bounding normal faults which separate high thermal conductivity bedrock from low thermal conductivity valley fill, and along which geothermal fluids may circulate. Modeling results suggest that information on the temperature of the fluid, dip of the fault, and vertical extent of the fluid circulation is contained in the heat flow anomaly pattern. Such information is valuable for exploration decisions. The models will be illustrated for geothermal anomalies at Vale Hot Springs KGRA, Oregon, and Roosevelt Hot Springs KGRA, Utah.

6381 Marysville geothermal project workshop. Blackwell, D.D. (Southern Methodist Univ., Dallas). pp 21-22 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The techniques used and results of the extensive geological and geophysical surveys carried out at the Marysville geothermal area will be more fully described in this workshop session for those interested in the details of the exploration and results. In addition the results of well logging and of core studies in the deep exploration test MGE-1 will be described. Studies on core samples verify in general the values of various properties determined from the well logs. The geothermal system is a hydrothermal cell operating in a distributed set of fractures (a reservoir) in an Oligocene granite. The production capacity of the reservoir was not tested. However, at Roosevelt Hot Springs, Utah, a geothermal system in a similar rock type appears capable of delivering commercial quantities of steam. Thus, exploration should not favor porous sedimentary and volcanic rocks and discrete fault zones as the only viable types of geothermal reservoirs.

NON-USA

REFER ALSO TO CITATION(S) 6395, 6406, 6414

GEOTHERMAL EXPLORATION AND EXPLORATION TECHNOLOGY

REFER ALSO TO CITATION(S) 6422

6382 Exploration of the Guanacaste, Costa Rica, geothermal system. Corrales, M.F. (Instituto Costarricense de Electricidad, San Jose, Costa Rica); Koenig, J.B.; Kuwada, J.T. pp 57-58 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Geothermal exploration was carried out along the lower flanks of 2 active volcanoes: Rincon de la Vieja and Miravalles, of the Cordillera de Guana-caste. There, 4 major fumarole complexes and numerous thermal springs are present along a 35-km-long northwest-trending zone. Exploration began with reconnaissance data collection along the fumarole belt. Numerous previously unrecognized thermal springs and fumaroles were found in the rugged terrain. This was followed by geologic mapping in the field and on photographs, at approximately 1 : 50,000 scale. Accompanying the geologic mapping was a program of field hydrochemistry. More than 100 springs, water wells, fumaroles and streams were sampled in an area somewhat in excess of 500 km^2. Specific conductance, pH, silica, chloride, ammonia and fluoride were determined in the field; specific-ion electrodes were used for certain major cations and anions in a field laboratory in the town of Liberia, some 25 km distant. The hydrochemical work was supplemented by collection and interpretation of hydrological data. A Lacoste-Romberg gravity meter was imported and used to collect some 600 gravity stations averaging about 1 per km^2. ICE geophysical staff had begun shallow Wenner-configuration electrical soundings. Thirty-five temperature-gradient holes were drilled to an average depth of 70 m.

GEOPHYSICAL TECHNIQUES AND SURVEYS

REFER ALSO TO CITATION(S) 6408, 7608

6383 Egyptian connection. Morgan, P.; Swanberg, C.A. (New Mexico State Univ., Las Cruces). *Geotherm. Energy Mag.;* 5: No. 10, 7-13(Oct 1977).

Studies on the earth's crust have been initiated in Egypt; data being collected indicate an interesting geothermal pattern, with geothermal potential along the Red Sea coast and possibly also in the Gulf of Suez. Results of heat flow, thermal spring, gravity, and magnetic studies are reported. (JGB)

6384 Subsurface temperature data in the Socorro Peak KGRA, New Mexico. Reiter, M.; Smith, R. (New Mexico Inst. of Mining and Tech., Socorro). *Geotherm. Energy Mag.;* 5: No. 10, 37-41(Oct 1977).

Subsurface temperature measurements were performed within the vicinity of the Socorro Peak KGRA in 11 drill tests ranging from 20 to 110m in depth. The locations of the sites are shown, temperature logs are presented, and basic subsurface temperature data are tabulated. Observed temperature gradients greater than 150°C/km are confined to the eastern part of the Socorro Mountain block. The possible roles of fluid movement and magma as sources of heat in the area are discussed. (JGB)

6385 Use of ELF measurements to supplement VLF and magneto telluric signals in electromagnetic prospecting. Follin, J.W. Jr.; Yu, K. (Johns Hopkins Univ., Laurel, MD). pp 97-98 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The use of the coherent ELF transmissions in prospecting for geothermal brines and other anomalous conductivity regions in the earth is discussed. The advantage of using these signals is that, first, they come from a powerful transmitter and antennas system, and, second, the coherent transmissions afford signal integration times of hours (if necessary). While the skin depth of these signals (45 and 75 Hz) restricts accurate measurements to depths of 2 to 5 kms, the precision with which they may be made provides significant information about subsurface geology. It is important to process VLF signals as well (12 to 18 KHz) to help separate the effects of surface terrain features, as well as magneto-telluric (MT) signals for probing deeper into the earth to obtain the full story of the structure of the anomalies being measured.

6386 Electrical investigations in the Guanacaste Geothermal area (Costa Rica). Furgerson, R.B. (Argonaut Enterprises, Denver); Afonso L., P.S. pp 99-100 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The Guanacaste Geothermal area in northwest Costa Rica consists of a zone of surface thermal features which run for 30 km along the flank of an active volcanic chain. An electrical resistivity sounding survey of 260 Wenner-array soundings and of 66 Schlumberger-array soundings found a thick zone (at least 800 to 1100 m) of low resistivity (averages 3 to 6 ohm-m) underlying most of the area. The wide extent, great thickness, and low uniform resistivity of this unit strongly suggest that it is a series of tuffs with warm to hot and/or saline pore water. Another possibility is that the low resistivity is caused by extensive alteration to clays. In any case, there is no evidence for high resistivity basement in the upper 1500 m of the section. The Las Hornillas thermal features are located on a horst in the resistivity structure which correlates very well with a thermal gradient high. Geoelectric units appear to show as much as 1100 m of throw on the southwest flank of the horst.

6387 Combined use of reflected P and SH waves in geothermal reservoir exploration. Goupillaud, P.L.; Cherry, J.T. (Systems, Science and Software, La Jolla, CA). pp 111-113 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The results are presented of a seismic test conducted over a known geothermal reservoir using seismic exploration technology to determine its capability for high resolution mapping of the reservoir. The East Mesa Reservoir of the Imperial Valley was selected for this test since its physical and lithological characteristics are relatively well defined by the existence of quite a few wells in the area. The survey was conducted with the cooperation of two seismic crews: one using four P-wave vibrators and one experimental SH "Vibroseis" crew operating two SH-wave vibrators. The final depth sections obtained with both types of waves are shown.

6388 Short period surface wave dispersion studies in the East Mesa Geothermal Field, California. Gupta, H.K.; Nyman, D. (Univ.

of Texas at Dallas, Richardson). pp 123-125 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The recently developed inter-station impulse response method of measuring surface wave dispersion is adapted to very short period waves and applied to microearthquake generated surface waves in the East Mesa Geothermal Field, California. This provides important information about shear wave velocity in the top few kilometers. Separate evidence indicates the presence of a low velocity channel with an apparent shear wave velocity of about 3.15 km/sec at a depth of 10 to 15 km.

6389 Reservoir depletion at the Geysers, California. Isherwood, W.F. pp 149 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Decreases in gravity measured at The Geysers between June 1974 and February 1977 indicate that water vapor being withdrawn from the field is not being replenished significantly by natural recharge. Measurements at precision gravity stations during that period now establish a pattern of decreasing gravity of a magnitude several times greater than what could be attributed to measurement errors. To cause the large gravity decrease that has been observed by removal of mass from depths greater than about 2 km would require withdrawal of far more than has actually been produced; therefore, water boiling solely off a water table deeper than 3 km is eliminated as an explanation. The system seems to be more accurately described as liquid-phase water in the pores within the reservoir which flashes to steam virtually in place, in response to the pressure decrease caused by nearby well bores.

6390 Geophysical studies at Lightning Dock KGRA, Hidalgo County, New Mexico. Jiracek, G.R. (Univ. of New Mexico, Albuquerque); Smith, C.; Ander, M.E.; Holcombe, H.T.; Gerety, M.T.; Swanberg, C.A. pp 157-158 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

An integrated geological, geochemical, and geophysical assessment of New Mexico geothermal areas included Lightning Dock KGRA. Reconnaissance gravity, magnetic, and roving dipole resistivity measurements have mapped bounding Basin and Range faults, 1.5 to 3.0 km of valley fill, and a buried ridge in the vicinity of shallow, hot wells. Detailed telluric and dipole-dipole surveys also detect the ridge; the latter results have been used to construct a preliminary 8-km long geoelectric section to a depth of 2 km. Five magnetotelluric soundings have been used to probe deeper. In particular, a conductive zone is apparent beneath the high resistivity ridge. Geologic mapping suggests that the thermal anomaly occurs at the intersection of a buried mid-Tertiary caldera and a visible Holocene fault. The ridge detected by geophysics may mark a sequence of rhyolite domes along a buried ring-fracture.

6391 Role of ambient microseisms in geothermal exploration. Liaw, A.L.; McEvilly, T.V. (Univ. of California, Berkeley). pp 187-188 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Analysis of seismic background noise is found to provide interpretable data for geothermal exploration, if proper sampling and processing methods are used. Noise characteristics are seen to be stable over times of months, when sampled at quiet (early morning) times. Continued noise power anomalies can be due to thick low relief surface material. Frequency-wave-number (F-K) processing allows mapping of wave propagation direction and velocity, providing information on structural variations and/or local noise sources.

6392 Geysers geothermal reservoir properties from seismological data. Majer, E.; McEvilly, T.V. (Univ. of California, Berkeley). pp 199 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

An east-west profile extending through the steam production zone at the Geysers Geothermal Field recorded two USGS refraction line explosions, plus 70 microearthquakes of magnitude -1.0 to 1.0 with depths of 1 to 5 km, during a 5-day study in September 1976. Data are presented and discussed briefly.

6393 Lake bottom thermal gradient survey at Clear Lake and Mono Lake, California. Martin, R.C.; Welday, E.E. (California State Lands Div., Long Beach). pp 201-203 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A one-meter temperature gradient survey method was tested at Clear Lake and Mono Lake, California for application in geothermal exploration. Temperatures of the bottom water and sediments at 20 cm increments were measured with a cable-operated probe. The lakes studied represent widely different thermal environments, but geothermal anomalies were successfully detected despite some rapid changes in lake bottom temperatures.

6394 ΔQ survey-Marysville, Montana, USA. McEuen, R.B. (San Diego State Univ., CA). pp 205-207 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

This summary describes a relative heat flow, ΔQ, survey that was carried out at Marysville, Montana. The selection of Marysville as a test site was predicated largely on previous work. This work defined clearly a thermal anomaly extending over several square miles. The relative heat-flow technique was employed with the addition of refinements which consisted primarily of large insulating pads to protect the transducers from thermal radiation from above. The purpose of the survey was to determine if the known anomaly could be detected at the surface. The survey results indicate that surface measured relative heat-flow values are capable of delineating thermal anomalies if relative changes in excess of 5 heat flow units are present in the area. The data also suggest that change in elevation with attendant change in seasonal near surface geothermal gradient, severely limit the relative heat-flow technique as presently practices.

6395 Geothermal investigation of the Lake District Ethiopia. McEuen, R.B. (San Diego State Univ., CA); Abakoyas, J. pp 208-210 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Three drilling locations have been selected to test geothermal reservoirs whose combined areal extent appears to exceed 80 km^2. All are associated with the West Langano Fault and are mainly confined to uplifted blocks immediately to the west of this fault. Apparent resistivities of less than 3 ohm-meter characterize the areas selected for testing. Resistivity values greater than 10 ohm-meter are typical of the Rift area in general. Gravity highs within the Rift may be associated with young intrusions representing possible deep-seated heat sources. The location of the geothermal resource at drillable depth seems, however, to be more dependent upon fault distribution than on the location of these possible deep-seated heat sources.

6396 Mapping seismic activity in geothermal regions. Page, E.A. (Ensco, Inc., Springfield, VA). pp 239-240 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Techniques to three dimensionally located sources of seismic ground noise have been developed and successfully applied to data recorded in several geothermal regions. This approach is based on the assumption that the dominant sources of ground noise in these regions are likely to originate from the dynamics of hot fluids, vapors, and active faults associated with the geothermal system. In the analysis of data recorded at Long Valley, ground noise sources coinciding with known faults and hot springs were detected. Both the field and signal analysis techniques were developed specifically for this application in conventional ground noise surveys, such as ground amplification and interference of cultural noise sources. The signal analysis involves use of nonlinear array processing techniques as well as techniques allowing for inconsistencies in the regional geology.

6397 Heat flow and geothermal gradient exploration of geothermal areas in the Cordillera de Guanacaste of Costa Rica. Blackwell, D.D.; Granados, G.E.; Koenig, J.B. (Southern Methodist Univ., Dallas). pp 17-18 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Heat flow and geothermal gradient exploration have been carried out in a 30 km long zone along the southwestern flank of the Cordillera de Guanacaste (a chain of andesitic strato-volcanoes) in Costa Rica as part of an integrated program of geothermal exploration. Several attractive targets have been drilled and an extensive

geothermal system on the slope of the volcano Miravalles associated with the fumeroles of Las Hornillas has been outlined. Additional drilling has been done at the areas of Borinquen and Las Pailas where fumaroles also occur. Extensive flow of groundwater off the flanks of the volcanoes has complicated the gradient exploration technique, but not severely. The geothermal systems outlined are probably typical of other similar geologic settings.

6398 Regional heat flow and the geothermal character of the Snake River Plain, Idaho. Brott, C.A. (Southern Methodist Univ., Dallas); Blackwell, D.D.; Mitchell, J.C. pp 31-32 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A regional heat flow study shows high heat flow (2.5 HFU or higher) on the margin while lower heat flow (1.7 HFU) is found in the western Snake River Plain (SRP). The distribution of the heat flow is interpreted to be related to the combined effects of crustal heat flow refraction and a large crustal magmatic heat source. A time progressive regional model in which the emplacement of heat source corresponds to the ages of the silicic volcanics in the SRP is presented. The model predicts high heat flow (2.5-3 + HFU) over all of the eastern third of the SRP. Confirmation of high regional heat flow in the eastern SRP will require deep wells because of regional water movement in the Snake Plain Aquifer. However, a close correlation of predicted heat flow and observed elevation changes along the axis of the SRP strongly supports the model. The possibility of high heat flow combined with the abundant recent volcanism implies that the eastern SRP has significant geothermal potential in spite of the low surface heat flow and lack of thermal manifestation.

6399 Seismic exploration for geothermal resources. Brown, P.L.; Butler, D. (MicroGeophysics Corp., Golden, CO). pp 33-35 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Parts of the theory are described and some results on new methods of seismic exploration for geothermal energy are presented. A non-exhaustive list is given of three methods for exploration: crustal scale refraction, Poisson's Ratio and Attenuation studies, and a seismic emission location scheme. A relevant piece of the theory for each method is reviewed and results presented where they are available.

6400 Seismic evidence for a deep heat source associated with the Coso geothermal area, California. Combs, J.; Jarzabek, D. (Univ. of Texas, Richardson). pp 33-35 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Analysis of both compressional (P) and shear (S) waves from a recent large mine blast indicates seismic anomalies associated with the Coso geothermal area in California. Five, short-period, high-gain, three-component and three, single-component, magnetic-tape recording seismographs were deployed in a fan configuration 100 km from the mine blast of October 26, 1976 located at 36°09.40'N and 117° 24.50'W. Relative P-wave delays were observed on ray paths which passed south of the surface manifestations and zone of high heat flow associated with the Coso Geothermal Area. The P delays and the strong attenuation of higher frequency P and S waves infer the existence of an extensive body of low velocity material at depth in the area north of Airport Lake and southeast of Volcano Peak, the youngest volcanics in the area with a K-Ar age of about 0.04 m.y. These travel-time delays and seismic attenuation suggest the possibility of a deep magma chamber which has provided the most recent basaltic and rhyolitic rocks and continues to function as a heat source for the Coso geothermal system.

6401 Seismic refraction and basement temperature investigation of the East Mesa Known Geothermal Resources Area, southern California. Combs, J. (Univ. of Texas, Richardson). pp 45-47 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Fifteen refraction shots located primarily in the East Mesa Known Geothermal Resources Area (KGRA) of southern California were detonated in March of 1976. These explosions, along with recording stations, were arranged to provide a distribution of directions and areal coverage to determine the nature of the Tertiary sedimentary section and the velocity of, and depth to, the underlying crystalline basement rocks of the East Mesa KGRA. Measured velocities varied from 1.70 to 5.40 km/sec and depth to basement was found to be 4.15 km. Although basement is 1.1 km deeper, the velocity is comparable to the 5.5 km/sec obtained 10 km to the north. Comparisons with published refraction profiles located in the Salton Trough and with continuous velocity logs from six wells (ranging in depth from 1.82 to 3.07 km) indicate similar velocity structure for the sedimentary section. By combining the refraction results with the measured bottom-hole temperatures from five geothermal wells, and the background gradient of 75°C/km, temperatures are predicted to range from 325°C to 365°C at the sediment-basement interface underlying the East Mesa KGRA.

6402 Thermal conductivity measurement techniques for geothermal exploration heat flow surveys. Combs, J. (Univ. of Texas, Dallas); Quiett, S.; Axtell, L.H. pp 49-51 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Although most thermal conductivity measurements for terrestrial heat flow surveys are made using variations of the divided-bar apparatus, the technique presents a number of constraints to the timely completion of thermal exploration for geothermal resources. The apparatus is a laboratory device and is both tedious and time consuming for routine processing of samples. Using the needle-probe method, consistent, reliable results can be obtained for saturated unconsolidated materials when proper corrections are made for volume of liquid. Thermal conductivities were obtained on solid cores of several rock types as well as numerous suites of drill cuttings. Divided-bar determinations were made on the solid cores which were crushed to powders and measured using the divided-bar cell and needle-probe techniques. Measurements corrected for water saturation have shown excellent agreement among the three techniques with an average difference of less than a few percent. Utilizing a recently developed field portable needle-probe apparatus, on-site thermal conductivity values can be obtained from drill cuttings in less than ten minutes.

6403 Geological and hydro-geochemical study of the Animas geothermal area, Hidalgo County, New Mexico. Dellechaie, F. (AMAX Exploration, Inc., Denver). pp 73-75 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The Animas Valley thermal area lies on the west pediment of the Pyramid Mountains. The Pyramids are composed of Cretaceous to Tertiary igneous rocks. Two hot wells produce 101°C water at a depth of 20 meters. The wells seem to relate to a northerly trending fault having at least 500 meters displacement with the west block downthrown. An elliptical heatflow anomaly extending about 3 km in length occurs in this area. Thermal waters contain about 1200 mg/l of dissolved solids and low concentrations of Li, B, NH_3 and H_2S. Silica concentrations do not exceed 145 mg/l. Cations and anions occur as: $SO_4 > Cl > HCO_3$ Na > Ca > K > Mg. Last equilibrium with a volcanic suite of minerals and carbonates is evidenced. Geothermometers indicate subsurface temperatures of approximately 160°C. Apparently the thermal waters are escaping rapidly from a deep (>4 km) reservoir along a conduit formed by fault intersections. Evidence of igneous heat is lacking.

6404 Seismic reflection investigations in a geothermal area. Denlinger, R.P.; Kovach, R.L. pp 77-78 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

6.5 Miles of 12-fold seismic reflection coverage using the Vibroseis technique were acquired in the southern part of the Geysers steam field in California to examine the applicability of active seismic techniques in geothermal exploration. The results have been most encouraging in that enhanced reflections have been observed across lithologic boundaries and fracture zones, believed to be the zones in which steam is extracted in the Geysers area. From the seismic reflection data there is a suggestion that several deep horizons, possessing amplitude anomalies, may represent fracturing along the main thrust fault zones at depth forming a main avenue of steam transport.

GEOCHEMICAL TECHNIQUES AND SURVEYS

REFER ALSO TO CITATION(S) 6379, 6390, 6403

6405 (USGS—1005, pp 58-60) **Lithium contents of thermal and mineral waters.** White, D.E.; Thompson, J.M.; Fournier, R.O. (Geological Survey, Menlo Park, CA). 1976.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

In Lithium resources and requirements by the year 2000. Reported lithium contents of natural waters range from less than 0.01 ppM to more than 500 ppM. Although absolute contents are of major interest in commercial recovery, the ratios of Li to other major constituents are more significant in evaluating origin and diverse effects of evaporation, dilution, and waterrock interaction. The most useful single ratio is Li/Cl, which is emphasized in this text, but Li/Na has nearly equal usefulness. Lithium/chlorine (by weight) is lowest in ocean water (0.00001) and becomes progressively higher in major North American rivers (0.00004) and in small streams and meteoric springs (variable and unreliable values because so dilute, but ranging from 0.001 to 0.1). For comparison, the ratios in major crustal types are granite, 0.15; basalt, 0.17; and shale, 0.38. Thermal and mineral waters of high salinity tend to have intermediate Li/Cl ratios, generally ranging from about 0.0001 to 0.001 (table 19). The median ratio for oil-field waters is probably near 0.0003, but a few ratios attain 0.001 and even higher; one notable example is brine from the Jurassic Smackover Formation of Texas and Arkansas, which averages 0.001. Individual analyses are greater than 0.002 and Li contents are as much as 500 ppM. Nearly all saline waters of high temperature geothermal systems are much enriched in Li. The Salton Sea brine (350°C and 26 percent salinity) has 215 ppM of Li (Li/Cl ratio of 0.0014 and an estimated 1.0 million tonnes of Li in 5 km^3 of brine). Moderately saline geothermal waters exceeding 200°C and closely associated with young silicic volcanism range from about 1 to 50 ppM of Li and have the highest Li/Cl ratios of any major group of thermal and mineral waters, ranging from less than 0.001 to more than 0.02. Li contents of various rocks and waters, including ocean and river, oilfield brines, evaporate brines, and waters of Yellowstone National Park, are tabulated. (JGB)

6406 Geochemical and hydrological investigations of the Guanacaste Geothermal Project, Costa Rica. Gardner, M.C. (GeothermEx, Inc., Berkeley, CA); Corrales, L.R. pp 101-102 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Geochemical investigations at the Guanacaste geothermal project area, Costa Rica, demonstrate that a thermal aquifer with temperatures as high as 240°C may exist in at least one zone of the project area. Two of the 3 zones of thermal manifestations in the project area are clearly shown by alkali and silica anomalies. The deep thermal aquifer appears to contain a sodium chloride fluid. Concepts of structural geology and hydrology were supported by geochemistry. Radiochemistry of tritium in groundwater indicates that velocity of water in the shallow system is about 1.5 to 6 km per year. Chemistry of the thermal and cool waters of the area also indicates that bimodal phases are present in the thermal system, at least locally, and that separate deep and shallow circulation systems occur. Additional geochemical and hydrological information is required to determine whether the natural recharge of the thermal aquifer will support production of the system.

EXPLORATORY DRILLING AND WELL LOGGING

6407 Summary of 1976 geothermal drilling: Western United States. Smith, J.L.; Isselhardt, C.F.; Matlick, J.S. *Geotherm. Energy Mag.;* **5**: No. 5, 8-9, 11-13, 15-17(May 1977).

In 1976 there were 52 wells and 13 deep observation holes drilled to explore for and develop geothermal resources in the States of California, Idaho, Nevada, Oregon, and Utah. This was an increase of 27% over the total number of locations drilled in 1975. Of the 52 wells drilled during 1976, 39 (75%) are now considered to have successfully found at least potentially commercial quantities of steam or hot water, 8 are otherwise suspended, and 5 were abandoned. Two new fields were discovered, in the Imperial Valley and Nevada, and four important extensions to production were made at The Geysers. The drilling activity for 1976 is summarized by state and by operator. The total footage drilled was 437,752 feet, which represents an increase of 82,609 feet (23%) over the total footage drilled in 1975. As in 1975, the three operators most active in 1976 were Union, Aminoil, and Republic Geothermal, based on footage drilled.

6408 Geothermal potential for Hawaii in light of HGP-A. Helsley, C.E. (Hawaii Inst. of Geophysics, Honolulu). pp 137-138 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Successful production of clean high temperature fluids from the HGP-A well have stimulated interest in the geothermal resource potential of basaltic volcanoes. As a result of this success, further exploration on other rift zones in Hawaii seems warranted. Data compiled from this well are reviewed briefly.

6409 Geothermal down hole velocity measurement device. Sandquist, G. (Univ. of Utah, Salt Lake City); Swanson, S.; Kunze, J.; Stoker, R. pp 275-276 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A method for measuring fluid velocity in a one direction flow stream is described using the change in ionizing gamma radiation incident upon a gamma ray detector where the distance between the detector and source varied with the fluid velocity. Sources for measurement error and reduced sensitivity are mentioned. (MHR)

6410 Deducing production zones from well logs. Stoker, R.C.; Goldman, D.; Kunze, J.F. pp 279-280 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Normal well logging techniques in the Raft River wells have failed to give definitive information about the actual production zones. The most useful tool has been the temperature log under non-equilibrium conditions, both flowing and quasi-static. The use of injected cold water has been a powerful tool in developing these non-equilibrium logging situations that have pinpointed the production zones.

6411 Preliminary well test results from HGP-A. Yuen, P.; Chen, B.; Kihara, D.; Takahashi, P. pp 309-310 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

See CONF-770569.

A test well, HGP-A, has been drilled by the Hawaii Geothermal Project on the island of Hawaii in the Puna district near the eastern rift of Kilauea Volcano. The well has undergone five flash discharge tests to determine operating characteristics and to obtain fluids for quality testing. The noise level from fluid discharging into the atmosphere is extremely high so a silencer/separator was constructed prior to discharge tests. Temperature and pressure profiles have been obtained for both quiescent and discharge periods for the well. Profiles during flashing tests are shown. Discharge test results indicate that temperatures and pressures at wellhead are sufficiently high to support a four-megawatt electric generator. (MHR)

6412 Downhole geothermal sondes. Archuleta, J.R. (Los Alamos Scientific Lab., NM). pp 7-8 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A program designed to demonstrate the feasibility of extracting energy from hot dry rock in the crust of the earth is being conducted at Los Alamos Scientific Laboratory (LASL). The system is based on the establishment of a pressurized water circulation loop created by drilling two holes from the surface and connecting them by means of a large crack produced by hydraulic fracturing. It was necessary to design specialized tools in order to investigate the hydraulic fracture; i.e., crack size, crack location, and the circulation loop. This was mandatory because the most logical source, the oil field-logging industry, did not have tools available that could survive the long term tests in a severe geothermal environment. Instruments used in fracture mapping often remain downhole for up to 12 hours at 200°C and 28 to 35 MPa (4000-5000 psi) hydraulic fluid pressure. Communication between the downhole instrument and a recording facility is via a high-temperature logging cable terminated at a downhole cable head which must maintain cable integrity for the duration of the test.

6413 Developments in geothermal logging technology. Ball, L.W. (Energy Research and Development Administration, Washington, DC). pp 11 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The Division of Geothermal Energy established a national program to improve the state of the art in logging technology. The program is described in both its strengths and shortcomings, several achievements are related, and some important programmatic needs are identified.

6414 Assessing geothermal areas during drilling. Batzle, M.L.; Simmons, G. pp 13-15 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

It is suggested that data collected and analyzed in near real-time can be used to predict reservoir conditions at greater depth. On the basis of preliminary examination of the core from Coso, Califor-

nia, it is speculated that low thermal gradients will probably occur at depth. The presence of extensive fracturing and low temperature alteration products in many fractures indicate widespread circulation.

LEGAL AND INSTITUTIONAL ASPECTS

REFER ALSO TO CITATION(S) 6370, 6425, 6427, 6442

6415 (CONF-7409169—, pp 167-179) **Sea-bottom, temperature-differential energy and legal perspective.** Sheets, G.M. Apr 1975.

From 2. ocean thermal energy conversion workshop; Washington, District of Columbia, United States of America (USA) (26 Sep 1974).

In Second Ocean Thermal Energy Conversion workshop: workshop proceedings.

Geophysical and engineering challenges presented by conversion processes inherent in making potential sea-bottom magmatic energy resources available are discussed in the light of recent developments in rock drilling and materials survival in molten rock. The legal aspects in view of this becoming technically feasible are discussed. The ways of characterizing geothermal resources and two prospective legal systems under discussion are mentioned. (MHR)

6416 **Geopressured geothermal resources of Texas.** Oberbeck, A.W. (Univ. of Texas, Austin). *Geotherm. Energy Mag.;* **5**: No. 8, 18-37(Aug 1977).

A comprehensive legal research project was proposed to examine the complex legal-regulatory framework within which any development of these geopressured resources would have to occur. As a first step in the proposed research, legal issues affecting ownership of the geopressured resources were examined. The results of that examination are reported as a possible aid in early resolution of a threshold issue for orderly resource development: ownership of the resource and ways of establishing ownership. Topics covered are: statutory resource definition, judicial theories of ownership, an analysis of ownership issues for Texas resources, and royalty considerations. (MHR)

6417 **Economic strategies toward the Federal sector: summary.** Kelly, R.L. pp 167-168 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The Federal government dominates the geothermal industry, imposing a series of economic risks and opportunities characteristic of government action. Representatives of the industry should learn to assess these risks and opportunities in a realistic manner and to take effective steps in connection with them. Case examples are provided illustrating these processes in both the executive and legislative branches and their potential outcomes.

6418 **Impact of geothermal energy development on the Heber area, Imperial Valley, California.** Meidav, M.Z.; Meidav, H.T. (Geonomics, Inc., Berkeley, CA). pp 217-219 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Population changes, occupations, housing, income, education, schools, and other socioeconomic factors of the Heber area are described. The effect of the demonstration geothermal power plant on employment and the tax base is discussed. (MHR)

6419 **Status of the Federal Geothermal Leasing Program.** Stone, R.T. pp 281-282 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Various aspects of the Federal Geothermal Leasing Program are reviewed. Since issuance of the regulations, 1.8 million acres of public and Indian lands have been leased for geothermal exploration and development. Unitized leases are discussed briefly. Some drilling activity is mentioned. (MHR)

ECONOMIC AND FINANCIAL ASPECTS

REFER ALSO TO CITATION(S) 6358, 6364, 6441

6420 (NP—21253-P1) **Geothermal power economics: an annotated bibliography. Volume I.** El-Ramly, N.; Peterson, R.; Seo, K.K. (Hawaii Univ., Honolulu (USA). Hawaii Geothermal Project). Feb 1974. 83p. of Hawaii, Honolulu.

Volume 1 contains annotations and abstracts of thirty-two papers on geothermal exploration, worldwide geothermal development, geothermal by-products, economic aspects, and environmental and legal aspects. A bibliography of 192 citations is also included. Individual items were previously indexed for the energy data base. (LBS)

6421 **Economic analyses of geothermal energy development in California.** Ramachandran, G. (Stanford Research Inst., Menlo Park, CA). pp 251-253 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The utilization of hydrothermal resources in California for future electricity generation is quite uncertain due to the current technical, economic, environmental, and institutional factors affecting their growth and development. The price of electricity from hydrothermal steam is estimated to be about 20 to 22 mills/kWh as compared to 25 to 40 mills/kWh from competitive sources of electricity. The technical and economic feasibility of hot water resources for electricity generation has not been proven commercially in California. For optimistic assumptions regarding economic parameters, the price of electricity from hot water resources in California can vary from 35 to 45 mills/kWh depending on the resource. There is considerable scope for hydrothermal contribution in base load capacity to the year 1995. However, for a significant contribution from hydrothermal energy, a hot water demonstration power plant and tax incentives to the resource producer are required in the near future.

6422 **Nomographic solution for preliminary economic evaluation of geothermal prospects.** Crosby, G.W. (Phillips Petroleum Co., Del Mar, CA). pp 69-71 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Nomographs have been developed that provide an aid to economic evaluation of geothermal prospects. Because of the need to average several rates that change with time, taxes and field production, for example, the nomographic solution is preliminary and does not substitute for more formal evaluations prior to an investment in deep drilling. Well rate and steam rate are inputed to determine a gross annual income adjusted to the price of steam. Recurring annual expenses are applied to determine the annual cash flow which is the money available to amortize the investment and produce the desired rate of return on the investment. Finally, number of years to payout is given by the nomographs.

ENVIRONMENTAL ASPECTS AND WASTE DISPOSAL

REFER ALSO TO CITATION(S) 6366, 6377, 6411, 6459

6423 (CONF-7511133—) **Geothermal environmental seminar.** (Lake County Air Pollution Control District, Lakeport, Calif. (USA)). 1975. 156p. County Air Pollution Control District, Lakeport, CA.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

Separate abstracts were prepared for twenty-four papers. (MHR)

6424 (CONF-7511133—, pp 5-14) **Hydrogen sulfide emission rates of fumaroles in the Geyser's geothermal region.** Tolmasoff, M.; Frazer, J.R.; Lewis, M.G. 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

The design of the sampling apparatus is shown and the sampling procedure is outlined. Eight fumarole fields studied are listed. The H_2S emission rates, H_2S concentration in steam, and the steam emission rates are tabulated. The error analysis and results are discussed. The results indicate that fumaroles emit about 120 lbs of hydrogen sulfide per day. (MHR)

6425 (CONF-7511133—, pp 15-17) **BLM needs for environmental facts.** Clausen, M. (Bureau of Land Management, Ukiah, CA). 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

The recent activities of the Bureau of Land Management (BLM) in the areas of regulations, land leasing, and environmental studies relating to geothermal energy development are reviewed. The need for information on air quality trends down wind from the

development and the effects of any changes in air quality on plant and animal life are mentioned briefly. (MHR)

6426 (CONF-7511133—, pp 18-23) **Needed studies for the future.** Champlin, J.B.F. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
It is suggested that future studies should clarify the systems within which variations in the environment occur, so that when actual, factual data is obtained, it fits and helps to calibrate or substantiate a functional model of what the natural operative system is. Future studies considered particularly germane to geothermal development are listed under the following headings: hydrogeothermal, hot rock, geopressured, hot brine, and geomechanical. (MHR)

6427 (CONF-7511133—, pp 24-26) **Public opinion concerning geothermal development in Lake County (integrated assessment).** Weres, O. (Univ. of California, Berkeley). 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
A further analysis of a public opinion questionaire sent out by a group of students at University of California at Berkeley to every sixth voter in Lake County is described. Attention was focused on the effects of environmental impact and an increase in jobs and taxes on public opinion. (MHR)

6428 (CONF-7511133—, pp 27-32) **Effects of hydrogen sulfide on plants.** Thompson, C.R.; Kats, G. (Univ. of California, Riverside). 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
The residence time of H_2S in the troposphere is about 18 hrs. during which time it is oxidized to SO_2. Continuous fumigation of alfalfa, grapes, California buckeye and Ponderosa pines with H_2S in carbon filtered air caused injury to all species at 300 and 3000 parts per billion. No overt injury or stunting was observed at 30 parts per billion. Sulfur accumulation occurred at all three levels of exposure with the faster growing broadleaf species accumulating the most.

6429 (CONF-7511133—, pp 33-36) **EIR dilemma.** Neilson, J. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
The problems involved in writing Environmental Impact Reports (EIR) are discussed. The EIR dilemma arises from six sources: (1) the time frame for collection and analysis of data and its spatial relationships, (2) inadequate monitoring systems, (3) lack of baseline data, (4) lack of scientifically and legally defensible data, (5) midstream changes in project definitions by industry, and (6) economic limitations. Suggestions for improving the situation are made. (MHR)

6430 (CONF-7511133—, pp 37-39) **Wildlife consideration in geothermal energy development.** Spaulding, W.M. Jr. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
The problems involved in the balance between the environmental impact of geothermal energy development on wildlife and the nation's energy needs are discussed in general terms. (MHR)

6431 (CONF-7511133—, pp 40-60) **Geothermal effluents, their toxicity and prioritization.** Schieler, L. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
The hazards associated with geothermal effluents are discussed, with emphasis on hydrogen sulfide, ammonia, radon 222 and associated daughter products, and toxic trace elements, in particular heavy metals. (MHR)

6432 (CONF-7511133—, pp 61-77) **Pacific Gas and Electric research and development.** Weinberg, C.J. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
Active research and development project span the following major categories: (1) environmental assessments, (2) hydrogen sulfide emissions abatement, (3) materials selection and protection, and (4) specialized engineering analysis. Active environmental assessment programs encompass stream flow and analysis, air quality, fish, stream quality vegetation, wildlife, and noise. The hydrogen sulfide emissions abatement program includes: controlled additions of metal catalysts, incineration of H_2S in the condenser off-gases, direct scrubbing of H_2S in the off-gases, and upstream H_2S removal. (MHR)

6433 (CONF-7511133—, pp 78-79) **Sampling techniques for geothermal wells.** Hyman, M.H. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
A brief description is given of the method and equipment used for sampling particulate and hydrogen sulfide emissions from steam wells during the drilling process. (LBS)

6434 (CONF-7511133—, pp 81-83) **Environmental and institutional aspects of geothermal energy development.** Citron, O.R. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
Attention is focused on the institutional and environmental considerations determined to be of primary significance by the JPL effort. The plan prepared by JPL recommended a number of actions which could be taken by the federal government to establish an environmental data base and develop environmental standards in areas where standards are insufficient, unnecessarily constraining to geothermal development, or nonexistent. The plan presents a compilation of existing environmental protection technology. Recommended actions are listed. (MHR)

6435 (CONF-7511133—, pp 85-90) **Presence and effects of heavy metals.** Robertson, D.E. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
A plan for a research program on heavy metals is discussed. The program consists of the following three phases: concentrations of the heavy metals in geothermal fluids, chemical species and physical forms of the heavy metals, and environmental dispersion and uptake of the heavy metals. The outline and content of each phase is described. (MHR)

6436 (CONF-7511133—, pp 91-95) **Air pollution and plants.** Millecan, A. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
The effects of air pollution on plants in Southern California are described. An attempt is made to show the applications to geothermal energy. (MHR)

6437 (CONF-7511133—, pp 106-108) **ERDA's role in geothermal environmental research.** James, D. (Energy Research and Development Administration, Washington, DC). 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
The U.S. Energy Research and Development Administration (ERDA) is a new organization and consequently is a recent entry into the geothermal environmental field. The Division of Biomedical and Environmental Research plans to emphasize studies of the ultimate environmental, biological and health effects of geothermal developmental activities. The division of Geothermal Energy, which is responsible for the developemnt of a viable geothermal technology, will support environmental studies needed to assist this development. ERDA's geothermal environmental studies thus far have concerned sites in several western states. A major effort will concentrate on the Imperial Valley of California.

6438 (CONF-7511133—, pp 109-114) **What's next.** Tucker, F. 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
Recent past, present, and proposed research activity in the Geysers is summarized. Those given special attention by the Lake County Air Pollution Control District are mobile laboratory hydrogen sulfide survey, micro-meteorological survey, botanical test plot documentation scheme, and rain-acid survey. The present status of these is described. (MHR)

6439 (CONF-7511133—, pp 115-121) **Weather modification.** MacKay, K. (California State Univ., San Jose). 1975.
From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).
In Geothermal environmental seminar.
Results of a series of meteorological and air quality observations in the Anderson springs region are discussed. The basic measurements included surface wind, temperature, and humidity and attempts to measure winds above the surface. Water vapor and hydrogen sulfide concentrations are tabulated. (MHR)

6440 (CONF-7511133—, pp 122-126) **Pacific Gas and Electric fish research results.** Price, D.G. (Pacific Gas and Electric Co., San Ramon, CA). 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

Fishery reports available are listed. The lack of steelhead trout is discussed. Temperature and water quality studies are described. (MHR)

6441 (CONF-7511133—, pp 127-130) **Federal funding.** Perhac, R.M. (National Science Foundation, Washington, DC). 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

One aspect of Federal funding is discussed, the segment which deals with National Science Foundation's support of environmental problems related to geothermal resources development. The philosophy is that of broad generic problems, environmental problems, collecting information and making studies of the type of information that would have application to a number of geothermal resource types. (MHR)

6442 (CONF-7511133—, pp 131-133) **Look ahead.** Freeman, R. 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

The interactions between environment, and energy, government regulations, public opinion, land use criteria, and government policies are sketched in general terms. (MHR)

6443 (CONF-7511133—, pp 134) **Sierra Club views on environmental research.** Hess, H. 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

The Sierra Club favors the development of geothermal resources under the conditions of adequate environmental protection and a program of land use planning which is responsive to natural values and social needs. We believe that many of the present adverse impacts of development and production can be eliminated or significantly reduced, and that the public acceptance of wide scale geothermal resource production is dependent on such reductions. In our view, the most serious present impacts which cannot be eliminated by careful field management are as follows: the biological and odoral effects of atmospheric emissions from geothermal production facilities; erosion and siltation resulting from extensive vegetation removal and land surface disturbance; high visual impact throughout a geothermal development area; topographical alteration in hilly terrain; noise from machinery and expanding gases; seismic and tectonic events. It is our position that present and proposed programs of monitoring and enforcement directed toward the reduction of specific impacts are necessary, but that these should not stand as a substitute for high priority research and development which can bring about radical innovations in the technology of geothermal resource production and utilization. In our opinion, the two most critically needed developments are sealed production systems and readily usable direction drilling control for off-sets up to one mile. If these could be effected, the problems of emissions, erosion and siltation, visual impact and topographical alteration could be all but eliminated.

6444 (CONF-7511133—, pp 135-143) **Regional mitigation of landslide induced impacts in the Geysers-Calistoga KGRA.** Dwyer, M.J. 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

The purposes of this paper are: (1) to briefly describe landslide conditions in the Geysers-Calistoga KGRA, (2) to summarize the impacts landsliding can have on the environment and on geothermal development, and (3) to discuss how these impacts can be significantly reduced through the predevelopment preparation of regional landslide and landslide susceptibility maps. Although the contents of this paper are directed primarily to geothermal development in the Geysers-Calistoga KGRA, the methods described would be applicable to other resource areas in mountainous, unstable terrain.

6445 (CONF-7511133—, pp 144-149) **California Department of Fish and Game study program.** Emig, J. (California Dept. of Fish and Game, Yountville). 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

The study described is designed as an assessment of the fish and wildlife populations and habitat of those portions of Lake and Sonoma Counties which have been or are most likely to be affected by geothermal development. The interest is centered on fish populations of this area, the water quality and channel compositions of the streams they inhabit, and also the major wildlife species groups, where they are found, and their maintenance requirements. (MHR)

6446 (CONF-7511133—, pp 152-154) **Farewell address.** Morgan, G.B. 1975.

From Geothermal environmental seminar; Clear Lake, California, United States of America (USA) (14 Nov 1975).

In Geothermal environmental seminar.

Effects of geothermal energy development on air quality is reviewed briefly with emphasis on radon and sulfur compounds, primarily hydrogen sulfide. (MHR)

6447 (UCRL—79977) **Survey of models to predict the effect of geothermal power development on domestic water supplies and to design pollution monitoring networks.** Pimentel, K.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Aug 1977. Contract W-7405-ENG-48. 15p. (CONF-770854—1). Dep. NTIS, PC A02/MF A01.

From Conference on modeling and simulation of land, air and water resources systems; Ghent, Belgium (30 Aug 1977).

The Imperial Valley is a 2,000-km^2 agricultural region in Southern California with annual crop values of more than $500 million. Geothermal reserves estimated at 130 GWe-yrs were found beneath this Valley. Development of that geothermal energy should occur in the next 10 to 20 years. To ensure that development is carried out in an environmentally sound manner, Lawrence Livermore Laboratory is engaged in a 3-yr study of the environmental effects that development of geothermal power production may have on the Imperial Valley. Preliminary work is described for a computer-modeling study to determine effects of such activity in one region of the Valley upon water quality in domestic artesian water wells in an area downstream from geothermal wells. Various models are considered to estimate contaminant concentration and transport dynamics and to design optimal monitoring systems for pollution surveillance of those domestic water wells.

6448 **Projections of future H_2S emissions and geothermal power generation: the Geysers Region, California.** Leibowitz, L.P. (Jet Propulsion Lab., Pasadena, CA). pp 183-185 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The future potential for geothermal power generation in the Geysers Region of California is as much as 10 times the current 502 MWe capacity. However, environmental factors such as H_2S emissions and institutional considerations may play the primary role in determining the rate and ultimate level of development. A scenario of future geothermal generation capacity in the Geysers region is described and simplified estimates for future H_2S atmospheric emission are presented. Problem areas which need to be addressed are summarized.

6449 **Surface disposal of geothermal brines.** Morrison, R.; Saint, P.; Weaver, D. pp 229-230 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The state-of-the-art of geothermal waste disposal on land is discussed. Disposal practices at seven case study sites located throughout the world will be discussed as part of this review. Ponding methodologies and monitoring systems utilized for hazardous wastes are presented in terms of their applicability to geothermal brines.

6450 **Status of baseline sampling for elements in soil and vegetation at four KGRA's in the Imperial Valley, California.** Crockett, A.B.; Wiersma, G.B. (Environmental Protection Agency, Las Vegas, NV). pp 65-67 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A major geothermal baseline study of the Imperial Valley in California is discussed. Statistically based sampling designs have been developed for monitoring elemental levels in soils and crops at the Salton Sea and the Known Geothermal Resource Areas at Heber, North Brawley and East Mesa. Samples have been collected at all locations. Analyses of samples collected around the test facility indicate that there are no significant differences in soil residue levels of lithium and manganese between the 50 sites. However, there are significant differences between sites for zinc.

BY-PRODUCTS

6451 (USGS—1005, pp 54-58) **Nonpegmatite lithium resource potential.** Vine, J.D. 1976.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

In Lithium resources and requirements by the year 2000.

The lithium content of most sedimentary rocks ranges from about 0.0005 to 0.01 percent, but rocks deposited in basins that contain evaporite minerals may contain 0.01 to 0.1 percent lithium, and clay minerals related to hectorite containing 0.3 to 0.5 percent lithium have been reported from several localities in the western United States. Although marine evaporite sequences that include potassium salts may suggest conditions favorable for the entrapment of lithium-rich brines, nonmarine evaporite basins probably represent the most favorable trap for concentrated lithium brines. Areas known to contain such exotic salts as borates and nitrates in nonmarine basins of Tertiary age also contain anomalous concentrations of lithium in clastic rocks, volcanic ashes, clays, and magnesium-rich carbonate rocks. Once dissolved, lithium tends to remain in solution in residual brines, even after evaporative concentration and precipitation of the salts of sodium, potassium, and magnesium. Brines associated with these evaporite minerals may contain as much as 1,000 times more lithium than seawater contains.

6452 (USGS—1005, pp 61-66) **Lithium recovery from geothermal fluids.** Berthold, C.E. (Hazen Research, Inc., Golden, CO); Baker, D.H. Jr. 1976.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

In Lithium resources and requirements by the year 2000.

The lithium resource of the Imperial Valley, Salton Sea KGRA (Known Geothermal Resource Area), in southern California, appears to be of significant size, comparable to the Clayton Valley, Nevada, lithium reserve in quantity of contained lithium. Lithium occurs, presumably as lithium chloride, in amounts of about 200 ppM (as Li) in the geothermal fluids obtained from depths of 5,000 feet or more (as typified by Sinclair No. 4 fluid). Recovery of lithium from this resource can be achieved by chemical concentration (precipitation) techniques and ion-exchange methods, both liquid and solid, among others. Preliminary results obtained in attempting to recover lithium from this resource are reported. The preferred method for Li recovery from Sinclair No. 4 geothermal fluid is the precipitation as a complex Li aluminate using either freshly precipitated Al hydroxide or in-situ precipitation of Al hydroxide via Al chloride with pH control.

GEOTHERMAL POWER PLANTS

REFER ALSO TO CITATION(S) 6448

DESIGN AND OPERATION

6453 (SAN/1137—5) **SDG and E/ERDA geothermal loop experimental facility. Bi-monthly report, January—February 1977.** Bishop, H.K.; Bricarello, J.R.; Enos, F.L.; Hodgdon, N.C.; Jacobson, W.O.; Li, K.K.; Mulliner, D.K.; Swanson, C.R. (Rensselaer Polytechnic Inst., Troy, N.Y. (USA)). Mar 1977. Contract EY-76-C-03-1137. 145p. Dep. NTIS, PC A07/MF A01.

Progress is reported in research on the Geothermal Loop Experimental Facility (GLEF), which operated for 758 hours during January and February 1977 with geothermal brine from both Magmamax No. 1 and Woolsey No. 1 wells. The facility was shut down for two weeks for the first major cleaning of the plant. The cleaning was accomplished by hand-scraping the large vessels, hydroblasting (high pressure water jets) portions of the reinjection line, and acid soaking, followed in most instances by hydroblasting, of the facility brine drain lines. The deepening of Woolsey No. 1 well to approximately 3490 feet was completed. Flow tests of Woolsey were attempted, with resumption of facility operation utilizing Magmamax No. 3 as the reinjection well. Insufficient geothermal fluid pressure at the Woolsey No. 1 wellhead resulted in several intermittent operations. Remedial measures undertaken included high pressure injection (hydrofracture) using a separate pump on Magmamax No. 2 and back flushing using a nitrogen purge on Magmamax No. 3. After these remedial measures were taken, the injection-well back pressure remained high, thus limiting the reinjection operation. Downhole data under these low flow conditions were gathered in order to determine further remedial actions. Typical reinjection conditions during this time were 400 gpm, 450 psig and 200°F at the plant boundary. Final Woolsey No. 1 wellhead conditions were approximately 200 psig and 400°F, indicating that an adequate supply of geothermal brine to the GLEF is very probable. No change in the GLEF brine and steam chemistry occurred during this reporting period. Scaling occurred throughout the system with the greatest deposition in the injection pump and lines. Scale composition varied from an iron, lead, silica mixture in the initial plant stages to a predominantly silica scale in the last stage and injection line. Installation of the electronic data logging system was completed. (JGB)

6454 **Conceptual design and evaluation of geothermal-driven 50 MWe power plants.** Harris, J.S. (Ford, Bacon and Davis Utah, Inc., Salt Lake City); Rogers, V.C.; Hansen, A.C.; Boehm, R.F. pp 131-133 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A conceptual engineering design and economic evaluation of a 50 MWe demonstration plant was recently completed for both direct contact and shell-and-tube heat exchangers with isobutane as the working fluid in a Rankine cycle. Preliminary results indicate the direct contact system is more economical than a conventional shell-and-tube heat transfer system on an installed capital basis but that total power costs are about equal.

6455 **East Mesa "Magmamax Process" power generation plant.** Hinrichs, T.C.; Falk, H.W. Jr. (Magma Power Co., Los Altos, CA). pp 141-142 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Magma is now constructing an 11,200 net kilowatt "dual binary cycle" plant at East Mesa in Imperial Valley, California, and expects to be operational in the spring of 1978. Unique features will include a new type of pump based on the design used in Iceland. A new type of very long heat exchanger tubes without baffling will be used. The turbine is a redesigned York compressor. A second power turbine operating on propane that will be heated to an approximate 93°C (200°F) is also being incorporated into the system, it is anticipated that this feature will be the first step towards development of equipment that will convert a variety of low temperature heat sources to electricity.

6456 **Recent operational experience at the SDG and E/ERDA Niland geothermal loop experimental facility.** Jacobson, W.O. (San Diego Gas and Electric Co., CA). pp 153-155 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Nearly one year of operational experience at the San Diego Gas and Electric/ERDA Geothermal Loop Experimental Facility has been generally very successful. The thermal energy of the high salinity, high temperature resource has been successfully extracted. Simplified control and handling of the brine and flashed steam/condensate has allowed: (1) scale to be removed, and (2) plant operators to anticipate problems, and (3) limited maintenance costs. Plant modifications have included (1) replacement of on-off controls with proportional elements, (2) revised pump bearings, and (3) replacement or modifications to valves.

6457 **Heber geothermal demonstration plant.** Lombard, G.L. (San Diego Gas and Electric Co., CA). pp 195-196 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

In 1973 SDG and E participated in well flow tests at Heber and in 1974 conducted a series of heat exchanger tests with the Heber fluid. This fluid contains 14,000 ppM and at a temperature of 360°F. These tests at Heber indicated no great difficulties with these fluids.

POWER PLANT SYSTEMS AND COMPONENTS

REFER ALSO TO CITATION(S) 6475

6458 (TREE—1081) **THERRP: a thermodynamic properties program.** Deeds, R.S. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1977. Contract EY-76-C-07-1570. vp. Dep. NTIS, PC A06/MF A01.

The computer program THERPP, a program that calculates the thermodynamic properties of light hydrocarbons and mixtures of light hydrocarbons is documented. A specific pressure—temperature or pressure—enthalpy grid is input to obtain properties in the desired region. THERPP is a modification of the program HSGC. Thermodynamic properties are calculated using Starling's modification to the Benedict-Webb-Rubin equation of state.

6459 **Air pollution emissions control for geothermal energy plants.** Tomany, J.P. (VTN Consolidated, Inc., Irvine, CA). pp 295-297 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Geothermal energy conversion plants comprise resource drilling, a fluid transmission network and the power generation plant. The extracted geothermal resource may be either water- or steam-dominated, with varying degrees of air pollution impacts associated with each of the operations for each fluid system. The major potential air-borne pollutants emitted by a geothermal energy extraction complex are particulates and hydrogen sulfide (H_2S).The latter gaseous contaminant is particularly evident at The Geysers, where steam-dominated resources are prevalent. A number of particulate and hydrogen sulfide emission control systems are currently being developed to ensure compliance with relevant air pollution regulations and standards in The Geysers region. A number of the more viable systems may soon be ready for commercial application.

6460 Report on the development of liquid fluidized bed heat exchangers. Allen, C.A.; Fanous, A.F.; Grimmett, E.S.; McAtee, R.E. (Allied Chemical Corp., Idaho Falls, ID). pp 5-6 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Two advantages have been demonstrated for liquid fluidized bed heat exchangers in geothermal systems: (1) Control of scale on heat transfer surfaces and (2) improved heat transfer rate compared to conventional tube and shell units which must use high fouling factors. Experiments have been performed with both synthetic brines and geothermal water from the Raft River and East Mesa Sites. Both horizontal and vertical configurations have been evaluated. For preheaters and boilers horizontal lay-outs appear to be less costly to build and development effort is now centered on these units.

6461 Overview of the geothermal program at the Lawrence Livermore Laboratory. Austin, A.L. (Univ. of California, Livermore). pp 9-10 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

It is proposed to develop the advanced technologies necessary for utilization of the high temperature/high saline (HT/HS) brines of the Salton Sea geothermal field located in the Imperial Valley, California. The program emphasizes development of the Total Flow energy conversion system with significant effort toward solution of the scaling, materials, and spent brine disposal problems. Currently, energy conversion engineering is confined to laboratory development and testing of a prototype conversion system using only "clean" working fluids (liquid plus vapor) typical of HT/HS wellhead thermodynamic conditions. Tests of a complete Total Flow impulse turbine system have been completed and verify the analytical performance models which indicate that existing designs are capable of 38 to 48% engine efficiency. It was established that scale deposition can be eliminated by acidification. Concurrent tests of turbine blade materials subjected to the high velocity acidified brine streams exiting from the test nozzles indicate that titanium alloys, particularly Ti-6A1-4V, are corrosion/erosion resistant.

6462 Equilibrium solubility considerations in direct contact geothermal power plants. Boehm, R.; Hellstrom, G.; Jacobs, H.; Hansen, C. (Univ. of Utah, Salt Lake City). pp 23-25 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Detailed studies of the equilibrium solubility of pentane, isobutane, R-113 and R-114 in varying salt concentration brines are given. Use of pentane in a direct contact power cycle results in the lowest fluid loss rate of the four fluids available here.

6463 Relative turbine costs for direct contact power plants. Boehm, R.; Bliss, R.; Jacobs, H. (Univ. of Utah, Salt Lake City). pp 27-29 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Performance and costs for turbines applied to direct contact heat exchanger geothermal cycles have been estimated. Relative costs that resulted from this study are reported. Performance was estimated by an extension of the theory of Balje. Using a Barber-Nichols cost equation, it is shown that there is an almost inverse correlation between the turbine cost and available energy density in the fluid. Fluids with higher vapor pressures (at the same temperatures) demonstrate lower cost turbines.

6464 Performance of a total flow impulse turbine. Comfort, W.J. (Univ. of California, Livermore). pp 53-55 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A new two-phase expander has been successfully tested in the laboratory. A numerical model was developed and was used to predict expander performance. The model was designed to allow extrapolations of performance both for full admission and for changes in droplet diameter. An engine efficiency of 23% for a single-nozzle test was measured. Performance predictions of a numerical model agree well with experimental results. Full admission performance, based upon the numerical model and achievable nozzle thrust coefficients indicate that full admission engine efficiency between 38 and 48% can be realized with present technology. Droplet size reduction and enhanced two-phase flow analysis techniques should make it possible to reach the research goal of 70% engine efficiency.

GEOTHERMAL ENGINEERING

DRILLING TECHNOLOGY AND WELL HARDWARE

REFER ALSO TO CITATION(S) 6407, 6433

6465 (COO—2677-8) Design of a water jet drill for development of geothermal resources. Annual progress report, June 1, 1976—May 31, 1977. (Missouri Univ., Rolla (USA). Rock Mechanics and Explosives Research Center). 1977. Contract EY-76-S-02-2677. 37p. Dep. NTIS, PC A03/MF A01.

Research was expanded to the drilling of crystalline rock. Advance rates of 40 inches per minute have been achieved at 16,000 psi, 10 gpm flow rate in a 30,000 psi compressive strength rock using the water alone as the drilling mechanism. The quality of the hole achieved as the jet drilled a variety of rock was found to vary and a hydromechanical drilling bit, combining high pressure water jets with roller cones, has been developed. A field drilling unit has been tested and modified to allow the drilling of holes to $3^1/_2$ inch diameter using the hydromechanical drill. Preliminary work on the development of a cavitation test for rock is also included.

6466 1977 drilling methods and costs at the Geysers. Glass, W.A. pp 103-105 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The Geysers is located approximately 75 miles north of San Francisco. It is the only area in the United States that produces steam commercially for electric generation. The drilling activity in this area has subsided mainly due to environmental and institutional barriers. The drilling methods over the past 5 years have not seen any major changes but the drilling costs have inreased tremendously. A typical 7,000 to 8,000' well drilled 5 years ago could have been drilled for approximately $400,000 while experiencing only minor problems. Today this same well would cost approximately $1,000,000. There are many conditions which add to normal drilling costs which sometimes can more than double the expected expenditures.

FLUID TRANSMISSION

6467 $CuSO_4$ process for removal of H_2S from geothermal steam. Harvey, W.W.; Brown, F.C. (EIC Corp., Newton, MA). pp 135-136 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Upstream scrubbing of geothermal steam with $CuSO_4$ solution removed over 90% of the H_2S content in a field trial at Unit No. 7 at The Geysers. The scrubber had a single sieve-tray with downcomer and handled about 1000 lb/hr of steam containing initially about 220 ppM of H_2S. About 80% of the NH_3 and H_3BO_3 contents of the steam were also removed. Under most test conditions, the H_2S removal rate was controlled by mass transfer in the vapor phase. Copper sulfide precipitates formed in the scrubber were readily and quantitatively regenerated to $CuSO_4$ by oxygen pressure leaching.

CORROSION, SCALING, AND MATERIALS DEVELOPMENT

REFER ALSO TO CITATION(S) 6453, 6460, 6461

6468 (BNL—50657) Cementing of geothermal wells. Progress report No. 4, January—March 1977. Steinbeg, M.; Kukacka, L.E.

(Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 14p. Dep. NTIS, PC A02/MF A01.

A coordinated program for the development of improved cements specifically designed for geothermal well applications was continued. Polymer cements (PC) have been identified as promising well cementing materials. Tests indicate that at temperatures above 218°C (425°C) only PC materials containing mixtures of silica and portland cement are durable to brine and steam. Differential thermal analysis (DTA) studies are underway to determine the reason. Tests are also being conducted on two monomer systems that may further extend the operating temperature range. (JGB)

6469 Materials evaluation for geothermal applications: turbine materials. Goldberg, A.; Garrison, R.E. (Univ. of California, Livermore). pp 107-109 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A number of candidate turbine materials are being evaluated for their resistance to erosion, corrosion, and stress corrosion cracking (SCC) in geothermal brines. These materials include Fe-, Ni-, Co-, and Ti-base alloys, coatings and ceramics. Tapered wearblades, simulating the leading edge of a turbine blade, are exposed to the direct impact of a two-phase nozzle exhaust. Bent beam SCC specimens, which are constrained in fixtures attached to the wearblade holders, are also exposed to this exhaust. The results of a test series in which acidified liquid brine was expanded to atmospheric pressure are described. The tests were performed at the LLL Field Test Station near Niland in the Salton Sea Geothermal Field. Evaluation of the exposed materials indicates that Ti-base alloys show the most promise for turbine wheel components in the high salinity geothermal environments.

6470 Field evaluation of scale control methods: acidification. Grens, J.Z.; Owen, L.B. (Lawrence Livermore Lab., CA). pp 119-121 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Brine modification experiments carried out during the Summer and Fall of 1976, at the Salton Sea Geothermal Field confirmed that siliceous scale formation is a pH-dependent process. The rationale for scale control was based on the premise that sulfide activity products and rates of silica polymerization and aggregation are reduced in acidic solutions. When separated brine from the Magmamax number 1 Well (nominal conditions: 200 to 230°C; 220 to 320 psig; pH 5.4 to 5.8) was acidified with sufficient hydrochloric acid to reduce the pH of expanded brine (1 atm, 102°C) to values between 4.5 and 5.0, scaling of simulated total flow turbine components was eliminated.

6471 Materials evaluation for geothermal applications: plant materials. Harrar, J.E.; McCright, R.D.; Goldberg, A. (Univ. of California, Livermore). pp 129-130 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Electrochemical measurement techniques are being used in the initial phase of this investigation to screen materials for corrosion resistance in low-pH brine, to establish the effect of pH on corrosion rate, to investigate the protectiveness of scale, and to aid in characterizing the brine itself. Apparatus has been developed to permit real-time measurement of corrosion rates by means of the linear polarization resistance technique, corrosion potentials, and the redox potentials and pH of flowing hypersaline brine at 100°C. A number of low-cost and more expensive materials with various heat treatments have been tested, and their general corrosion rates correlate well with the amounts of alloying Cr and Mo. Preliminary data also indicate that the silica scale formed from unmodified brine affords some protection against corrosion in acidified brine.

6472 Solids control for high salinity geothermal brines. Hill, J.H.; Otto, C.H. Jr.; Morris, C.J. (Univ. of California, Livermore). pp 139-140 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Solids which precipitate when high salinity geothermal brines are cooled can cause extensive erosion and plugging to occur in power plant components. During reinjection of spent brine, they may also cause plugging of the formation adjacent to the reinjection wells. This report describes work done to characterize these solids and control their production by acidifying the brine to a pH <4.5. At this time, control by acidification seems to offer an attractive alternative to conventional methods (filtering, settling, etc.) for removing suspended solids from spent brine prior to reinjection.

6473 LLL geothermal field laboratory. Locke, F.; Grens, J.; Tardiff, G. (Lawrence Livermore Lab., CA). pp 191-193 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Hypersaline geothermal fluids at high temperature and pressure are chemically complex and not easily duplicated in the laboratory. For development of a brine-tolerant conversion system for use at the Salton Sea Geothermal Field, a suitable field test facility was needed for evaluation of brine chemistry and materials problems such as scaling and corrosion. Design philosophies for a field test laboratory were dictated by the necessity of producing a multipurpose mobile test bed, easily reconfigured for testing of various components comprising a conversion system. A degree of mobility was desirable to maintain the option of testing more than one geothermal source. Provisions were also required for sampling, analysis and characterization of the fluids produced during experiments.

6474 Groundwater characteristics and corrosion problems associated with the use of geothermal water in Klamath Falls, OR. Lund, J.W.; Culver, G.; Lienau, P.J. (Oregon Institute of Tech., Klamath Falls). pp 197-198 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The shallow geothermal reservoir in Klamath Falls extends for at least eleven kilometers in a northwest-southeast direction with a width of about three kilometers. More than 400 wells ranging in depth from about 30 meters up to 600 meters, and obtaining or contacting water from 21 to 110°C, have been drilled into the reservoir. Over 100 wells have been investigated in detail in the urban area as to water level, temperature profile and chemistry. In addition a selected number of key wells have been measured periodically over several years to monitor changes in water level, temperature and chemistry. The Langelier Saturation Index, based on pH, has been found to predict scaling and the possibility of corrosion. Various metal coupons were placed in wells for a six-month period to give more precise data relating chemistry and corrosion.

6475 Heat exchanger fouling tests at Raft River. Mines, G.L.; Whitbeck, J.F. (Idaho National Engineering Lab., Idaho Falls). pp 221-223 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Heat exchanger fouling tests were conducted at Raft River to establish the geothermal fluid side fouling factors to be used in the Raft River thermal loop design. The tests were first conducted with materials that would not corrode severely to determine the effect of potential mineral deposition. These tests are currently being repeated using carbon steel and Monel 400. The test system and test results are described.

6476 Properties of siliceous scale from the Salton Sea Geothermal Field. Owen, L.B. (Lawrence Livermore Lab., CA). pp 235-237 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Evaporative concentration of depressurized hypersaline brine from the Salton Sea Geothermal Field (SSGF) results in rapid deposition of siliceous scale (heavy metal sulfides and iron-rich amorphous silica) on brine-exposed surfaces. The scaling problem is aggravated by high flow rates typical of producing wells in the SSGF (nominally 1.8×10^5 kg brine/hour) because even a minuscule mass transfer of dissolved constituents from brine to scale is sufficient to rapidly clog flow lines and render valves and other critical components of energy conversion systems inoperable. In view of the complexity of natural brines at high temperature and pressure, a field-oriented experimental program was initiated with supporting laboratory studies of scale compositions and microstructures. Results of these activities were supplemented by appropriate literature reviews in order to identify effective control measures that might subsequently be evaluated in the field.

6477 Scale and solids deposition in the SDG and E/U.S. ERDA Geothermal Loop Experimental Facility at Niland, California. Quong, R. (Lawrence Livermore Lab., CA); Bishop, H.K.; Hill, J.H. pp 249-250 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The scale deposition rate and the production of suspended solids during the operation of the SDG and E/U.S. ERDA Geothermal Loop Experimental Facility are described. In general, scaling and total suspended solids increase with process progression to lower temperatures. The major scale constituent is an iron-rich amorphous silica. Heavy metal sulfides, mainly galena, comprise as much as 40 wt. percent in scales deposited in the 1st stage, decreasing to less than a percent in the injection pipe. The elemental composition of the suspended solids in the brine is similar to the composition of the scale deposited at the same location. The exception is in the 1st stage, where metal sulfide enrichment occurs in the scale deposits.

GEOTHERMAL RESERVOIR AND WELL PERFORMANCE

REFER ALSO TO CITATION(S) 6409, 6474

6478 Comparison between theoretical and experimental well flow and analysis of self-flowing versus pumping. Elliott, D.G. (Jet Propulsion Lab., Pasadena, CA). pp 89-90 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

An approximate theory for self-flowing geothermal wells has been developed which gives reasonable agreement with available well data. The theory numerically integrates the steady-flow energy equation for vertical two-phase flow with friction, heat transfer, and slip. The approximate theory was applied to the problem of self-flowing versus pumping. A surprising result was that the flow rate of self-flowing wells at low reservoir temperatures appears to be limited chiefly by choking at the wellhead. A possible method of increasing the flow rate is to use enlarged casing above the flash level. The effect of doubling or tripling the diameter is shown. The performance of the same well at constant diameter with a pump of 500 kW output (volume flow rate times pump pressure rise) is shown for comparison.

6479 Numerical simulator for flow in geothermal wellbores. Juprasert, S.; Sanyal, S.K. (Geonomics, Inc., Berkeley, CA). pp 159-161 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A computer program has been developed to simulate the flow of hot water or steam-water mixture in geothermal wellbores. Given the temperature, pressure and flow rate of the water (or steam-water mixture) at the bottom of the well; the diameter, length and friction factor of the wellbore; and the static temperature profile along the wellbore, the program calculates the pressure, temperature, enthalpy and steam quality of the steam-water mixture (or water, if no flashing takes place) at the wellhead or at any specified depth in the wellbore. Conversely, given the fluid condition at the wellhead, the program can calculate the fluid condition downhole. Thus, the program provides a continuous profile of the flowing pressure, temperature, enthalpy and steam quality in the wellbore. This program uses an improved, more efficient approach than the ones reported in the literature. So far the program has been tested successfully for two wells from the East Mesa geothermal field.

6480 Modeling thermal and flow fronts for arbitrary well arrays. Kasameyer, P.; Thorson, L.; McKee, C. (Lawrence Livermore Lab., CA). pp 163-165 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A computer code has been developed, which uses an analytical solution for the pressure distribution to calculate fluid flow patterns within an arbitrary array of geothermal production and injection wells. The approximate location of the thermal front due to reinjection is also calculated. The code has been used to evaluate well use at the Magma-SDG and E geothermal site in the Salton Sea Geothermal Field.

6481 Raft River wells and reservoir performance. Kunze, J.F.; Miller, L.G.; Stoker, R.C. pp 177-178 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The three successful deep wells in Raft River have tapped a 300°F reservoir. The wells are artesian, but their use dictates pumping to achieve the maximum production rates. Well performance and production rates over many years indicate about 2 MW(e) per well using the binary cycle is predicted, and this at only 12% thermal efficiency. Use for non-electric direct heat represents 16 MW/well over the long term. Drilling technique and methods of determining the resource presence so as not to case it off have been the keys to getting the maximum production from these wells. Three channels in the bottom of the third well increased its production 5 times compared to one channel.

6482 LBL geothermal well-testing program. Narasimhan, T.N.; Schroeder, R.C. (Univ. of California, Berkeley). pp 231-232 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Starting September 1975, Lawrence Berkeley Laboratory has been involved with the testing of geothermal wells at Raft River Valley, Idaho and at East Mesa in the Imperial Valley. A preliminary attempt was also made to conduct a test at Heber in the Imperial Valley. Currently, tests are continuing at East Mesa. In addition to the collection of reservoir data, the well-testing activities have also included: (a) evaluating and improving available equipment needed for well-testing and (b) developing improved techniques for interpretation of field data. Measuring methods and equipment are described briefly.

6483 Well operations-Salton Sea geothermal field. Nugent, J.M.; Vick, L.R. pp 233-234 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Significant geothermal reservoir operating experience was gained in the Salton Sea Geothermal Field in the Imperial Valley of Southern California. The geothermal field operation consists of two production wells and two injection wells providing fluid supply and fluid disposal for the ERDA-San Diego Gas and Electric Company Geothermal Loop Experimental Facility at Niland. Some operating problems have been experienced with the Woolsey No. 1 production well and the two injection wells. Analysis and maintenance including logging, deepening, workover and testing have been performed. These operations provide empirical insights into the day to day operation of a high temperature, high salinity hot water geothermal reservoir.

6484 Numerical simulation of the effects of reinjection upon the performance of a geopressured geothermal reservoir. Pritchett, J.W.; Garg, S.K.; Riney, T.D. (Systems, Science and Software, La Jolla, CA). pp 245-247 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A general computer model was developed which can be used to simulate the behavior of Gulf Coast geopressured geothermal reservoirs undergoing fluid production and/or fluid injection. The model considers all of the important drive mechanisms and their interactions and is capable of representing reservoir heterogeneity and anisotropy in one, two and three-dimensional configurations. The results of these calculations would seem to make a strong case for reinjection into geopressured acquifers as a production technique.

6485 Energetics of geothermal fluid delivery via two-phase flow. Ridgway, S.L. (R and D Associates, Marina del Rey, CA). pp 255 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

For geothermal well Mesa 6-1 the Hagedorn-Brown correlation and Wallis' drift flux slug flow model both predict pressure drops in reasonable agreement with experiments, but the Hagedorn-Brown method suggests increasing the well bore diameter to improve performance and Wallis' model suggests reducing it.

6486 Decline curve analysis-a useful reservoir engineering tool for predicting the performance of geothermal wells. Rivera R., J. (Comision Federal de Electricidad, Mexico City, MX). pp 257-259 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

It is shown that the theory of decline curve analysis, which has been widely used in the petroleum industry for quite a long time, can be applied for predicting and studying the behavior of both geothermal wells and geothermal reservoirs as a whole. A study was

made of several wells of the geothermal field of Cerro Prieto, Mexico; this work includes the results obtained for three of them, which were judged to be the more representative cases. In addition to the application of the decline curve theory, an analysis of the history of flowing well conditions was made by means of the data of pressure vs depth and temperature vs depth taken during the wells productive life. All these data were analyzed together in order to know what the conditions of the wells were after flowing for some time. Predictions of future production from the wells were made based upon the assumptions of both hyperbolic and exponential declination type.

6487 Pressure and temperature measurements and sampling in geothermal wells. Ross, L.W.; Brown, L.L.; Williams, R.E. (Univ. of Denver). pp 265-267 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Denver Research Institute, in the course of a program for establishing a manual for the design of wells for exploitation of hydrothermal sources of geothermal energy, developed a need for highly accurate temperature and pressure measurements, and for determining the chemical composition of the fluid deep within the well, before flashing took place. Therefore, DRI reviewed the scientific principles available for performing such measurements, and designed a probe for T and P measurements in real time. This probe was tested for the first time in well 8-1 in the East Mesa field in September 1976. The sampler selected for high temperatures is based on a design that was developed at the Los Alamos Laboratories, but commercially available samplers can be used at temperatures up to about 400°F. Laboratory and field results, and a comparative review of measurement tools available to the geothermal industry, are reported. Experiences of other investigators, and current industry trends, are also summarized.

6488 Super heating of geothermal steam at Larderello. Tonani, F.B. (Geochemex, Inc., Berkeley, CA). pp 299-300 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Superheating of originally saturated geothermal steam is mainly controlled by flow conditions, i.e., by effective separation of steam from water and by the fact that the flow is isoenthalpic. Additional superheating relative to isoenthalpic flow of initially saturated steam sometimes occurs at high flow rates and heat transfer from the country rock may not contribute significantly to it. The change of kinetic energy to thermal form was suggested earlier as an explanation for this additional superheating at high flow rates, and evidence published since appears to support this view.

6489 Production and reinjection in geothermal reservoirs. Tsang, C.F.; Lippmann, M.J.; Witherspoon, P.A. (Univ. of California, Berkeley). pp 301-303 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

See CONF-770569.

Recent efforts at the Lawrence Berkeley Laboratory in the study of fluid production and injection in liquid-dominated geothermal reservoirs are reviewed. Two major approaches, a semianalytical method and a three-dimensional numerical model, are described. Five examples are discussed: (1) a production-injection doublet, (2) a system with nine production and five injection wells, (3) temperature recovery after a period of injection, (4) consolidation during fluid withdrawal, and (5) transient pressure response during a production-injection-production procedure.

6490 Production of geothermal brine wells in two-phase flow. Coury, G.E. (Coury and Associates, Inc., Lakewood, CO). pp 61-63 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Hot geothermal waters, containing dissolved gases and salts, normally flash to form a two-phase flowing mixture of steam and water during production up deep wells. Shifts in chemical equilibrium then occur due to release of CO_2, often causing deposits of $CaCO_3$ and well plugging. Prediction of flow rate versus pressure drop is difficult because little data exists for vertical two-phase flow in large lines; certain minimum flows are required; and flow equations for both the reservoir and the well must be considered. A computer program being developed both predicts the point of $CaCO_3$ scaling, and permits evaluation of various correlations for total pressure drop versus flow rate. Calculated results show that different correlations give significantly different solutions. Thus, a goal of this study is to develop reliable correlations based on both laboratory data and new data from field tests.

RESERVOIR STIMULATION AND EXTRACTION TECHNOLOGY

6491 (RLO—2227-T21-1) Secondary recovery method for the extraction of geothermal energy. Annual progress report, July 1, 1975—June 30, 1976. Bodvarsson, G. (Oregon State Univ., Corvallis (USA)). Jul 1976. Contract EY-76-S-06-2227-021. 87p. Dep. NTIS $5.00.

The concept of forced geoheat extraction involves an artificial circulation of water through natural fluid conducting structures in sufficiently hot rock. Several types of structures, viz., fault zones, dikes, formation contacts and sedimentary horizons are available for this purpose. The water is to be pumped into the structures through a series of relatively deep boreholes and will be recovered by other boreholes. The fluid conductivity may be of natural origin or be forced by a relatively high pumping pressure. The simplest situation is obtained when a fault zone or dike of high natural fluid conductivity is available in a favorable subsurface temperature environment. Relatively simple heat conduction theory is available to estimate the fluid/rock contact area required to absorb from a homogeneous temperature environment a given amount of heat during a given period of time. The theory can be extended to cases of a non-homogeneous initial temperature of the rock and time varying flow rates. The size of the contact area is the main criterion as to the realizability of forced geoheat extraction systems. Of particular interest are systems that deliver heat for non-electrical uses in the Pacific Northwest. Theoretical considerations indicate that the contact areas required for an economical operation of such systems are not excessive and appear within the possibilities of present day technology.

6492 Los Alamos Hot Dry Rock Geothermal Energy Project. Pettitt, R.A. (Los Alamos Scientific Lab., NM). pp 241-242 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The LASL Hot Dry Rock Geothermal Energy Project is the only U. S. field test of this geothermal resource. In the LASL concept, a man-made geothermal reservoir would be formed by drilling a deep hole into relatively impermeable hot rocks, creating a large surface area for heat transfer by fracturing the rock hydraulically, then drilling a second hole to intersect the fracture to complete the circulation loop. In 1974, the first hole was drilled to a depth of 2929 m (9610 ft) and a hydraulic fracture was produced near the bottom. In 1975, a second hole was directionally drilled to intersect the fracture. Although the desired intersection was not achieved, a connection was made through which water can be circulated.

DIRECT ENERGY UTILIZATION

6493 Geothermal heat for Presbyterian Intercommunity Hospital and Klamath County Nursing Home. Howard, R.L. (Presbyterian Intercommunity Hospital, Klamath Falls, OR); Hubbard, K.; Rosecrans, D. *Geotherm. Energy Mag.;* **5**: No. 8, 8-9, 11-14(Aug 1977).

The geology and hydrology of the Klamath Falls area is discussed briefly. The geothermal heating system which serves the Presbyterian Intercommunity Hospital and the Klamath County Nursing Home is shown in photographs and schematic drawing. The system consists basically of a well, settling tank, various heat exchangers, pumps, piping, and controls to move the water. From the heat exchangers system water is pumped to the terminal units, where it is used for space heating, domestic hot water, and a glycol snow melting system. The operation of the various parts of the system is described. (MHR)

6494 Direct heat applications of geothermal energy resources and the second law of thermodynamics. Elmer, D.B. (Tracor, Inc., Austin, TX). pp 91-92 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The Second Law of Thermodynamics is the proper measure of efficiency in end use of energy resources. The available work content of energy resources is a function of the temperature difference from ambient. The efficiency in utilization of this available work depends on the degree to which characteristic end use temperature requirements are matched to the characteristic temperatures of the available work content of energy resources. The characteristic temperature needs of more than 42% of present national end use of energy resources is less than 150° centigrade. Geothermal resources may have available work at temperatures of from 15 to 150° centigrade in the amount of from 640 to 1935 QUADS out of a total of from 735 to 2404 QUADS. On this basis the greatest efficiency of

use of the available work content of more than 80% of all identified or expected geothermal resources is for direct heat applications in district heating, commercial and industrial process and space heating. Furthermore, deposits of low temperature geothermal energy are well situated for potential retrofit and new direct heat applications.

6495 Computer aided feasibility assessment of geothermal non-electric projects. Engen, I.A.; Keller, J.G.; Donovan, L.E. pp 93-94 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Computer programs have been developed as aids to feasibility assessment of geothermal resource development. The GEOR code effects matching of entries in a file of geothermal resource information with an entry or a file of entries representing potential geothermal users or developers. Matching may be restricted as to location or resource attributes thereby aiding the program user in determination of the feasibility of development for specific uses by a developer or class of developers. The GEOTHE code performs an economic analysis of a specified geothermal project based on technical and economic considerations. Parametric studies may be made to examine the impact of technical or economic uncertainties thereby aiding in the feasibility assessment of the proposed project. Matching of geothermal resources with a class of potential user and typical results from an economic feasibility assessment of a geothermal space heating conversion project are presented.

6496 Total energy recovery system for agribusiness. Fisher, L.A.; Black, A.R.; Fogleman, S.F.; Singh, D.P. (International Engineering Co., Inc., San Francisco). pp 95-96 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Improvements in agribusiness biologic cycle efficiencies are attainable in controlled environments which utilize energy recovered from geothermal resources that are not suitable for power production. By combining greenhouse crops, mushroom culture, fish farming and biogas generation into an integrated biologic system, the waste or byproducts of each subsystem cycle can be recovered to service input needs of companion cycles. The results of a study to evaluate the costs and viability of such combined thermodynamic and biologic cycles in a system known as the Total Energy Recovery System for Agribusiness (TERSA) are presented.

6497 Geothermal space heating for low-income homes at Edgemont, SD. Hardy, B.; Chiang, C.W. (South Dakota School of Mines and Tech., Rapid City). pp 127-128 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The Western South Dakota Community Action Program has funded the South Dakota School of Mines and Technology to research the feasibility of geothermal space heating for low income homes. An artesian well at Edgemont, SD was selected as a heating source due to its noncorrosive, 127°F temperature water. The hot water will supplement existing heating systems for the six low income homes located within 600 feet of the well. Hot water will be piped to each home. Utilizing a baseboard system, heat will be extracted by natural convection. The water will then be piped back to the city lines. The size of the baseboard system is analyzed and tested by experimentation. Emphasis is placed on low cost design and easy installation. A preliminary study indicates a two gallon per minute flow rate will heat the average 700 square feet living space.

6498 Size effect for district space heating in Boise, Idaho. Kunze, J.F.; Donovan, L.E.; Griffith, J.L. (Idaho National Engineering Lab., Idaho Falls). pp 179-180 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Heating portions of the city of Boise with geothermal water seems attractive, because the 170°F resource was confirmed with drilling in the summer of 1976 to be within 1½ miles of the downtown business district. However, the capital cost of installing pipelines to transport the hot water under the city streets is so large a capital investment that nearly full capacity utilization is necessary to recover the investment. Furthermore, enhancing the annual utilization factor on the pipelines to the maximum is necessary in the moderate temperature climate. A doubling of the utilization factor is possible by using fossil fuel to peak the system on the few cold days. Design of the geothermal system so that fossil must peak for about 6% of the heating needs during the season appears to give the optimum return on investment.

6499 Klamath Falls geo-heating districts. Lienau, P.J.; Lund, J.W.; Culver, G. (Oregon Inst. of Tech., Klamath Falls). pp 189 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Two geothermal district heating systems have been proposed in the downtown Klamath Falls area for space heating of twenty-two commercial size buildings from two hot water wells. In addition, an investigation was conducted for supplying geothermal fluids to 110 equivalent buildings, in the downtown business core from eight production wells.

6500 Boise geothermal project. Mink, L. (Boise State Univ., ID); Hollenbaugh, K.; Donaldson, P.; Applegate, J.; Stoker, R. pp 225-227 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Utilization of geothermal waters for space heating in the Boise area has a long and successful history. In 1890 enterprising men sought to develop the springs so wells were drilled and the water piped to what was then one of the world's largest natural hot mineral water natatoriums. Shortly after the natatorium was completed the hot water lines were extended down Warm Springs Avenue to begin heating homes. The heating of these homes has been continuous since the system was started. Past history and recent geologic, geophysical and hydrological information indicate there is a capable geothermal reservoir in the area near Boise, Idaho.

6501 Utilizing Raft River geothermal water for irrigation. Schmitt, R.C. (Idaho National Engineering Lab., Idaho Falls); Peterson, H.B. pp 277-278 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

About 12.5 acres, of which part had no previous cultivation, were subdivided by crops and irrigation practices for investigation with the geothermal water and a control comparison water from the relatively pure Raft River. The geothermal water was cooled with a cooling pond to about 95°F prior to application. Flood and sprinkler application techniques were used and wheat, barley, oats, grasses, alfalfa, potatoes, and garden vegetables were grown. Sprinkler application has the advantage of zero runoff and also offer plant evaporative cooling of the water. A hazard is greater damage to the crop from the salty water applied to the leaves. Examples of wheat and barley crops at time of maturity are shown. The experiment addressed heavy metal uptake in plants, plant fluoride retention and damage, plant tolerances to salts, soil alterations and other behavior as a result of the geothermal fluids. Results to date indicate little difference in yield and composition between the geothermal watered crops and those obtained with fresh water and little difference between sprinkle and surface irrigation. Heavy metal concentrations were not excessive and fluorine levels are well below tolerance limits. Typical results are shown for oats. Neutron activation was effective for analyzing crop constituents and produced results comparable to chemical analyses as indicated.

6502 Ammonia absorption geothermal district heating and air-conditioning system. Taylor, R.J.; Toth, W.J. (Johns Hopkins Univ., Laurel, MD). pp 287-288 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A new concept in district heating and cooling is proposed here which should greatly increase the potential for non-electric utilization of moderate and low temperature geothermal sources. The ammonia absorption district heating system opens the possibility of transporting low grade heat hundreds of miles with essentially no thermal losses. The key to this ability of efficient energy transport is that the low grade heat is stored chemically in ammonia vapor at ambient temperature. Since the ammonia vapor is at ambient temperature, there are no thermal losses with time. Thus, the low grade heat can be stored indefinitely. This also means that the ammonia vapor can be piped hundreds of miles with only pumping losses, not thermal losses. Another reason this proposed system can greatly increase geothermal source utilization is its long term "thermal" energy storage capability.

GEOTHERMAL DATA AND THEORY

PROPERTIES OF AQUEOUS SOLUTIONS

6503 Chemical modeling of geothermal systems. Jackson, D.D. (Lawrence Livermore Lab., CA). pp 151-152 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

A computer modeling study is described which simulates individual chemical reactions in geothermal brines at high temperatures. It has been found that many such chemical changes in flowing process systems can be predicted by relatively simple equilibrium calculations. The procedure makes use of effective activity coefficients for ions which take into account the effects of extensive chloride complexing. The results are illustrated by several examples of chemical processes in fluid from the Magmamax number 1 well. These include sulfide species distribution, PbS precipitation, pH changes, and buffering effects due to the carbonate content. Such estimations have been found to be consistent with the actual observed behavior. The method is also generally applicable to geothermal fluids, where-ever chemical composition and temperature are known.

6504 Model for the calculation of the bulk thermodynamic properties of geothermal fluids. Potter, R.W. II.; Haas, J.L. Jr. (Geological Survey, Menlo Park, CA). pp 243-244 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Models were developed for predicting the bulk thermodynamic properties of complex brines found in geothermal systems. The vapor pressure may be calculated from the boiling and freezing points of the brine, and the density may be calculated from the sum of the densities of the binary components. These calculated parameters can be used to erect a P-V-T-X grid from which the thermodynamic properties may be extracted. If the brine has a freezing point, boiling point, and density similar to a solution with known thermodynamic properties, then the thermodynamic properties of the reference solution can be used to describe the properties of the brine. NaCl solutions are thermodynamically well known in the P-T range of geothermal interest. Furthermore, NaCl is one of the dominant constituents of most geothermal fluids. Experimental studies confirm that for most synthetic brines in the system Na—K—Ca—Mg—Cl—SO_4—Br, the boiling point, freezing point, and densities are equal to those of NaCl reference solutions. From the freezing point of the brine, the equivalent NaCl concentration can be determined and the thermodynamic properties of the geothermal brine calculated.

6505 Calculation of brine properties. Dittman, G.L. (Univ. of California, Livermore). pp 79-80 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Simple mathematical expressions for estimating the brine properties of density, saturation pressure, enthalpy and entropy above 80°F and for salt contents between 5 and 25 wt% have been generated. They are based on existing data for constant composition water solutions of primarily sodium chloride and for several concentrates of natural seawater. Comparison of the properties predicted by the relationships employed here and the data used to generate the expressions indicates very good agreement (less than 6% difference) for the temperatures and salinities considered.

ROCK-WATER-GAS INTERACTIONS

6506 (USGS—1005, pp 142-147) **Behavior of lithium in experimental rock—water interaction studies.** Dibble, W.E. Jr.; Dickson, F.W. 1976.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

In Lithium resources and requirements by the year 2000.

Experiments on the interaction of granitic rock and water at temperatures as high as 275°C and pressures as high as 500 bars show that lithium can be readily removed from crystalline igneous rocks and may attain aqueous concentrations similar to those found in natural hydrothermal waters. Some of the lithium can be extracted, at high rates, from such rocks before hydrothermal alteration occurs, this indicating that this lithium is held in cracks or on intergranular surfaces, perhaps as remnants of original pore fluids. Water-rock interaction experiments over periods of several months show that alteration of minerals in the rock will also contribute lithium to solution. Natural high-temperature water—rock interactions could be expected to contribute significant quantities of lithium to near-surface regions where it would be incorporated into stable mineral structures or would remain in subsurface solutions.

6507 Interaction of granite with aqueous sodium carbonate. Holley, C.E. Jr.; Blatz, L.A.; Tester, J.W.; Grigsby, C.O. (Los Alamos Scientific Lab., NM). pp 147-148 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

The interaction of granitic rocks with aqueous sodium carbonate was studied at 200° in Teflon lined steel bombs. The experiments are described. As expected, the amount of dissolved silica increased with increasing sodium carbonate concentration and with increasing time, but by 96 hours had leveled off at a value determined by the sodium carbonate concentration. The rates can be correlated by the rate law d(SiO_2 aq)/dt = ak(SiO_2/sup sat//sub aq/ - SiO_2 aq) where a is the ratio of rock surface area to solution volume and k is a function of the temperature, the rock type, fluid velocity, and various other parameters of the system.

6508 Solubility of gases in fluids under geothermal conditions, estimation methods and example calculations. Ross, L.W. (Univ. of Denver). pp 269-270 of In Geothermal: state of the art. Davis, CA; Geothermal Resources Council (1977).

From Geothermal Resources Council; San Diego, California, United States of America (USA) (9 May 1977).

See CONF-770569—.

Gases in geothermal fluids may limit the exploitation of the resource by their effects on two-phase flow or their effect on scale formation. Fundamental theory is available to predict these effects, but data are limited except in the case of CO_2, and wide discrepancies are found even in the case of CO_2. The effect of dissolved salts on solubilities has been studied only with CO_2. From the known data, certain predictions can be made on such questions as the appearance of the vapor phase in flashing wells, and the onset of calcite deposition as a result of CO_2 release.

TIDAL POWER

6509 (DGE/2293—3(Vol.1)) **Tidal power study for the United States Energy Research and Development Administration. Final report. Volume 1.** Wayne, W.W. Jr. (Stone and Webster Engineering Corp., Boston, Mass. (USA)). Mar 1977. Contract EX-76-C-01-2293. 209p. Dep. NTIS, PC A10/MF A01.

The results of a study of the feasibility of tidal power utilization in the United States are presented. The study covered the following areas: (1) the current status of tidal power in the world today; (2) the potential for the use of tidal power; (3) potential sites in the U.S.; and (4) environmental, societal, and legal consequences of a major tidal power project.

6510 (DGE/2293—3(Vol.2)) **Tidal power study for the United States Energy Research and Development Administration. Final report. Volume 2.** (Stone and Webster Engineering Corp., Boston, Mass. (USA)). Mar 1977. Contract EX-76-C-01-2293. 365p. Dep. NTIS, PC A16/MF A01.

Appendices to a comprehensive tidal power study (DGE/2293-3 Vol. 1) are presented. They include a bibliography, maps, various tabulated data, and results of ancillary studies.

WAVE ENERGY CONVERTERS

6511 Wave-powered pneumatic system for power generation. Bolding, R.D. US Patent 4,013,379. 22 Mar 1977. Filed date 26 Sep 1974. 6p.

A wave-powered pneumatic system for producing compressed air to be used for energy storage or power generation is described which comprises an elongated seawall extending parallel to the shore and at a distance out from the shore, upon which an air-accumulating structure is built. The air-accumulating structure is divided by partitions into a plurality of modules, each consisting of a plurality of stacked air chambers arranged one above the other. Each of the chambers is relatively shallow in the vertical dimension, and each chamber is closed on all sides except the end facing out to sea. A plenum chamber is connected to each of the air chambers by separate ducts having check valves which allow air to flow into the plenum chamber when pressure within the duct exceeds the pressure in the plenum chamber. The plenum chamber is connected to the air storage or power generating means. Depending upon the wave height, one or more of the chambers will be filled with a solid mass of water from each wave as the latter moves toward shore. This mass of shoreward-moving water acts as a piston, driving the air trapped in the chamber toward the rear end thereof, and compress-

ing it, the compressed air being forced out through the duct to the plenum chamber, and finally to the air-driven power generating means. 8 figures.

6512 Wave power apparatus supported and operated by floats in water. Diggs, R.E. US Patent 4,013,382. 22 Mar 1977. Filed date 14 Oct 1975. 10p.

An apparatus for converting water wave movement into power is described. A float is located in a body of water, and the apparatus converts the up and down movement of that float caused by waves in the water to operate a pump to displace hydraulic fluid through a hydraulic pumping station which actuates fluid motors, or the like to produce power. The force of the float movement is multiplied by a mechanical advantage so that the pump displaces the hydraulic fluid on both the upward and downward movement of the float even in calm water. A plurality of modules are interconnected to take advantage of as much of a wave front as desired. 11 figures.

WIND ENERGY

REFER ALSO TO CITATION(S) 6981

6513 (TAC-W—75-700) **Wind energy utilization: a bibliography with abstracts. Cumulative volume 1944/1974.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). 1975. 503p. Dep. NTIS, PC A22/MF A01.

To compile this bibliography, the Technology Application Center utilized a combination of computerized data bases and manual searching techniques to retrieve and evaluate wind information from throughout the world. Among the more significant sources searched were: Scientific and Technical Aerospace Reports (1963-74). Engineering Index (1962-74), Government Report Announcements (1964-74), Energy Abstracts (1973-74), International Aerospace Abstracts (1962-74), the Oklahoma State University Synopsis of Energy Research, plus a number of published documents on the subject of wind. In addition, valuable input was provided by Brace Research Institute of Canada's McGill University, the Alternative Sources of Energy in Mukwonago, Wisconsin, and the Electrical Research Association of Leatherhead, England. Citations are grouped under the following headings: general; utilization; wind power plants; wind power generators; wind machines; wind data and properties; energy storage; and related topics.

AVAILABILITY (CLIMATOLOGY)

6514 (BNWL/WIND—4) **Summary of wind data from nuclear power plant sites.** Verholek, M.G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Mar 1977. Contract EY-76-C-06-1830. 342p. Dep. NTIS, PC A15/MF A01.

A summary of wind data from nuclear power plant sites is presented. National Weather Service archives are an immediately obvious source of wind data, but additional data sources are also available. Utility companies proposing to build nuclear power plants are required to establish on-site meteorological monitoring programs that include towers for collecting wind and temperature data for use in environmental impact assessments. These data are available for more than one hundred planned or operating nuclear power plant sites. A list of the sites, by state, is provided in Appendix A, while Appendix B contains an alphabetical list of the sites. This site wind data provides a valuable addition to the existing NWS data sets, and significantly enlarges the multilevel data presently available. The wind data published through the NRC is assembled and assessed here in order to provide a supplement to existing data sets.

6515 (BNWL/WIND—5) **Synthesis of national wind energy assessments.** Elliott, D.L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1977. Contract EY-76-C-06-1830. 59p. Dep. NTIS, PC A04/MF A01.

A synthesis is described of existing national wind energy assessments to develop an improved consistent assessment of the geographical distribution of the available wind power over the United States. Previous national wind energy assessments have been reviewed with respect to techniques, assumptions, data sets/summaries, and interpolation schemes used. The overall representativeness of the resource maps produced has been evaluated. Discrepancies exist among previous assessments with regard to geographical variations and the estimated values of wind power. Information from the existing national wind energy assessments and various other sources has been selectively used to form a synthesized national assessment. As part of the synthesis, additional research was performed to further improve the national assessment. This included a more detailed examination of some of the inherent problems with respect to the representativeness and reliability of the surface and rawinsonde wind data, techniques employed in the vertical extrapolation of wind power, in the estimation of wind power over mountainous and offshore areas and areas of sparse data, and in the analysis and interpolation of the values.

6516 On the energy pattern factor in wind measurements. Buick, T.R.; Doherty, M.A.; McMullan, J.T., Morgan, R.; Murray, R.B. (New Univ. of Ulster, Coleraine, Ireland). *Int. J. Energy Res.;* **1**: No. 2, 127-133(1977).

Measurements of energy pattern factor K/sub e/ were made using a continuous-analogue wind-power metering technique, rather than by the more usual sampling procedure. The values obtained were significantly larger than the usually accepted figure. The discrepancy is attributed partly to the method of measurement, which includes the actual power present rather than the amount that can be extracted, and partly to the use of rather more typical wind speeds. It is concluded, however, that more energy can be derived from wind schemes than was thought, even during periods of light wind. These conclusions improve the viability of wind power plants.

WIND ENERGY ENGINEERING

REFER ALSO TO CITATION(S) 6516

TURBINE DESIGN AND OPERATION

6517 Rotor/generator isolation for wind turbines. Mirandy, L. (Boeing Vertol Co., Philadelphia). *J. Energy;* **1**: No. 3, 180-188(1977).

The interface dynamics between the rotor and electrical generator are analyzed for horizontal-axis constant-rpm wind turbine systems. Coupled equations of motion for the rotor, drive shaft, and generator are developed and solved to obtain the system natural frequency and forced response characteristics. It is concluded that isolation via a soft drive shaft should be used to keep vibratory torque inputs to the generator within acceptable levels. It is also shown that this isolation can be accomplished with realistic designs. Sample calculations are carried through for a two-bladed, 265-ft-diam, 1000-kW system.

6518 Aerodynamic design of a conventional windmill using numerical optimization. Vanderplaats, G.; Fuhs, A.E. (Naval Postgraduate School, Monterey, CA). *J. Energy;* **1**: No. 2, 132-134(1977).

Numerical optimization techniques are identified as an effective tool for automated synthesis of windmill design. Several simple design examples are presented to show the efficiency and generality of these methods. The extension to more sophisticated design problems is discussed, and the advantages and limitations of these techniques are identified.

6519 Aerothermic power plant with artificial cyclone. Nazare, E. pp 773-776 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

A tower of the venturi type is conceived so that air convected by solar heat be guided into accelerator ducts. The whirl having been thus started, the Coriolis forces due to the rotation of the earth sustain the cyclone rotation. With a difference of temperature of 50°C, a 300 m high tower could produce 650 MW of electricity. For equal power a tower will cost 4 times less than a nuclear power plant. It can also complement the conventional plants by recuperating part of the 60 percent thermic energy lost to the atmosphere. The cycle being natural, it will not create any ecology disorder and can in certain cases constitute a climatic regulator.

POWER CONVERSION SYSTEMS

6520 (ERDA/NSF/AER/00647—76/2) **Development and adaptation of field modulated generator systems for wind energy applications. Final report.** Ramakumar, R.; Hughes, W.L.; Allison, H.J. (Oklahoma State Univ., Stillwater (USA). School of Electrical Engineering). Aug 1976. Contract ERDA/NSF-AER-75-00647. 417p. Dep. NTIS, PC A18/MF A01.

Initial large-scale entry of wind energy is expected to be in the fuel-conserving mode. Wind energy will be converted to constant frequency ac electrical form, to be pumped into an existing utility grid. Wind driven field modulated generator systems allow the aeroturbine rotational speed to vary optimally with wind to maintain a constant and high coefficient of performance for the aeroturbine and enable the extraction of a part of the energy spilled by constant speed systems. This approach has the potential to lead to lower cost per kWh of wind generated electrical energy. The main objective of this project is to utilize experimental and analytical methods to develop understanding of the field modulated generator system so that this device can be better designed, scaled, utilized and

optimized. These studies are necessary for the successful integration of such systems in the national energy picture and for the evolution of cost effective wind energy conversion systems.

ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 6965

POWER PLANTS AND POWER GENERATION

REFER ALSO TO CITATION(S) 5784, 5792, 5793, 6968, 7048, 7049

COOLING AND HEAT TRANSFER EQUIPMENT AND SYSTEMS

REFER ALSO TO CITATION(S) 7465

6521 (BNWL—2182) **Estimation of benefits from demonstrating advanced wet/dry cooling technology: a framework and partial analysis.** Currie, J.W.; Foley, T.J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-06-1830. 61p. Dep. NTIS, PC A04/MF A01.

An analysis was performed to estimate reductions in future electric power generation costs expected to occur through a proposed 6- to 10-MWe demonstration of an ammonia (NH_3) cooling concept. Theoretical and empirical research on technological substitution and diffusion were reviewed in developing the analytical framework and computer model used in this analysis. Stochastic learning and market penetration functions were used to derive benefit distributions for two primary scenarios. The distributions provide not only single best estimates of the benefits, but measures of the uncertainty surrounding the estimates as well. The benefits were estimated by subtracting the net present value of expected future cooling costs if no demonstration were to take place from the net present value of expected future cooling costs if the demonstration did take place. If the public demonstration does not occur, two scenarios were hypothesized: ammonia cooling will never be commercialized; and ammonia cooling will be commercialized at a later date than if the demonstration had occurred. The analysis suggests that the benefits from a public investment in demonstration would probably exceed the estimated $10 million project cost.

6522 (COO—4114-2) **Waste heat management in the electric power industry: issues of energy conservation and station operation under environmental constraints. Second quarterly progress report, December 1, 1976—March 1, 1977.** (Massachusetts Inst. of Tech., Cambridge (USA)). 25 Mar 1977. Contract EY-76-S-02-4114. 12p. Dep. NTIS, PC A02/MF A01.

Progress in assessing the environmental impact and energy conservation aspects of waste heat management of thermal power plants is reported. Computer programs are being formulated for optimizing the design and simulating the performance of various cooling systems including wet cooling towers with forced or natural draft, dry cooling tower, cooling ponds, and once-through cooling systems. Economic and technical background data is also being assembled. (LCL)

6523 **Apparatus for recapturing lost energy in a thermoelectric generating plant.** Fiss, E.C. US Patent 4,016,725. 12 Apr 1977. Filed date 20 Jun 1975. 6p.

Apparatus is described for recapturing a portion of the energy normally lost in a thermoelectric generating plant utilizing heat to generate electric energy and having a recirculating water system in which the water is heated during passage through the plant and which must be cooled before recirculation to the plant thus causing a heat loss and resultant loss of energy. The apparatus includes a natural air draft, cooling tower for the flow of air from the bottom to the top thereof and disposed in the recirculating water system for receiving the heated water and passing the heated water through the flow of air at generally the bottom thereof for cooling the heated water and heating the air to cause a natural draft flow of air up through the tower. A rotor is positioned within the cooling tower for being rotated by the natural draft flow of air therethrough and an electric generator is driven by the rotor to generate electric energy and thus recapture a portion of the normally lost energy from the plant.

POWER CYCLES

REFER ALSO TO CITATION(S) 6532, 7059

6524 (FE—2357-14) **CFCC development program monthly report for April 1977.** (General Electric Co., Schenectady, N.Y. (USA). Energy Systems Programs Dept.). Apr 1977. Contract EX-76-C-01-2357. 29p. Dep. NTIS, PC A03/MF A01.

Progress in research on coal-fired combined-cycle power plants is reported. Information is included on evaluation of commercial plant design; design of steam generator auxiliary equipment; and study of materials for gas turbine components. (LCL)

6525 (FE—2357-15) **CFCC development program monthly report for July 1977.** (General Electric Co., Schenectady, N.Y. (USA). Energy Systems Programs Dept.). Jul 1977. Contract EX-76-C-01-2357. 24p. Dep. NTIS, PC A02/MF A01.

Progress in research on a coal-fired combined-cycle power plant is reported. The commercial plant design effort is being shut down during the preparation of design review documentation. Cost quotations for combustor/steam generator auxiliary equipment are being obtained. Burner rig testing is underway. A final report on hot gas clean-up efflux characterization which includes re-evaluation of the gas turbine erosion specification was prepared. Testing of the modified granular bed filter continued. (LCL)

6526 (FE—2371-12) **Evaluation of a pressurized-fluidized bed combustion (PFBC) combined cycle power plant conceptual design. Monthly report for period ending May 31, 1977.** Huber, D.A. (Burns and Roe Industrial Services Corp., Paramus, N.J. (USA)). Jun 1977. Contract EX-76-C-01-2371. 32p. Dep. NTIS, PC A03/MF A01.

Progress in developing the design of a combined-cycle power plant and in calculating the cost, operating parameters, and performance of the plant with pressurized (PFB) and atmospheric (AFB) fluidized-bed combustion systems is reported.

6527 **Calculation of the optimal flowrate of water into the high-pressure economizer of a steam and gas turbine combined power unit.** Popov, A.I.; Vinogradova, G.B. (Saratov Polytech Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 5, 58-64(May 1977). (In Russian).

A method and results of calculation of optimal flowrate of feedwater into the economizer of a steam and gas turbine combined power and technological (residual oil pyrolysis) unit with the capacity of 300 MW, depending on different initial data and operating conditions, are presented. It is shown that, with a reduced load, the relative value of the flowrate of feedwater into the high-pressure economizer increases. For certain conditions at reduced loads, it is advantageous to disconnect high-pressure heaters of the steam turbine.

6528 **Thermodynamic cycle of gas turbine plants with variable efficiencies of bladed machines.** Lapin, Y.D. (Moscow Higher Tech Sck im, N.E. Bauman, Kaluga, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 5, 142-145(May 1977).

Problems of thermodynamic analysis of cycles of gas turbine power plants with a regenerator and without one, given variable efficiencies of bladed machine using polytropic efficiencies are considered. Relations are presented for the determination of the characteristic stages of pressure increase and for maximum cycle efficiency. Russian.

6529 **Economic effect of utilization of gas turbine power plants to cover electric load peaks in power systems.** Tyryshkin, V.G.; Doinikova, Y.P.; Il'ina, L.V.; Bashlykova, G.N.; Antonov, O.N.; Bodrov, I.S.; Makarov, V.N. (Cent Sci Res Boiler and Turbine Inst, USSR). *Energomashinostroenie;* **42**: No. 1, 5-7(Mar 1977). (In Russian).

Results of economic calculations of load peak variants of the unified electric power system of USSR's Northwest with steam power plants and gas turbine power plants for the year 1980 and for a long-term perspective are presented. Recommendations are given regarding a reasonable extent of use of gas turbine power plants to cover peak loads and requirements regarding their characteristics.

6530 **Participation of a combined steam and gas turbine heat-and-power plant in covering peak loads.** Lyubimov, A.A.; Ozerov, V.I. (Lenenergo, Leningrad, USSR). *Energomashinostroenie;* No. 5, 7-9(1977). (In Russian).

Results of operation of a commercial combined steam-and-gas-turbine power plant with a VPG-120 high-pressure boiler, with steam injection into the gas turbine, are presented. The character of variation of the compressor working point with different concentrations of the steam/gas mixture is shown. Optimal parameters of the steam injected into the gas turbine are determined and advantages of steam-and-gas turbine combined heat-and-power plants with steam injection in peak operating conditions are given.

6531 (ERDA-tr—305) **Better fuel utilization by operation of gas/steam turbosets.** Gassert, H. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)). 1976. Translation of German report. 13p. Dep. NTIS, PC A02/MF A01.

A study was made of combined cycle power production using combined gas/steam turbines. The advantages of combined plants have become visible only after the gas turbine development in the last few years has enabled gas inlet temperatures of over 800°C in

the case of stationary gas turbines. The initially-mentioned incentive for combination is only then well-founded thermodynamically when the gas inlet temperatures essentially are above the steam turbine inlet temperatures. The combined plants can occupy an important place in the middle load range and in addition older steam power plants can be economically changed over by cutting gas turbines into the circuit instead of steam boilers. It should be noted that the environmental impact can be reduced by proper fuel utilization in the combined plants.

COMPONENTS

REFER ALSO TO CITATION(S) 5878, 5879, 5881

6532 (ERDA/NASA—5022/77/1) **Potential benefits of a ceramic thermal barrier coating on large power generation gas turbines.** Clark, J.S.; Nainiger, J.J.; Hyland, R.E. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Jun 1977. Contract EX-76-A-29-10227. 57p. (NASA-TM—73712). Dep. NTIS, PC A04/MF A01.

The purpose of this study was to determine which thermal barrier coating design option offers the greatest benefit in terms of reduced electricity costs when used in utility gas turbines. Options considered include: increased firing temperature, increased component life, reduced cooling air requirements, and increased corrosion resistance (resulting in increased tolerance for dirty fuels). Performance and cost data were obtained via contracts with Westinghouse and United Technologies Corporation. Simple, recuperated and combined cycle applications were considered, and distillate and residual fuels were assumed. The results indicate that thermal barrier coatings could produce large electricity cost savings if these coatings permit turbine operation with residual fuels at distillate-rated firing temperatures. The results also show that increased turbine inlet temperature can result in substantial savings in fuel and capital costs.

6533 (FE—1237-38) **Multicell fluidized-bed boiler design, construction and test program. Interim report, July 1974—June 1975.** Mesko, J.E.; Reed, R.R.; Malik, J.; Gamble, R.L.; Warshany, F.R. (Pope, Evans and Robbins, Inc., New York (USA). Combustion Systems Div.). Nov 1975. Contract EX-76-C-01-1237. 228p. Dep. NTIS, PC A11/MF A01.

Design, construction and test program of a 300,000 lbs/hr steam generation capacity multicell fluidized-bed boiler (MFB), as a pollution-free method of burning high-sulfur coal, or highly corrosive coals without excessive problems, is being carried out. The concept involves burning fuels, such as coal, in a fluidized-bed of limestone particles that react with the sulfur compounds formed during combustion, to reduce air pollution. Nitrogen oxide emissions are also reduced at the lower combustion temperatures. The $CaSO_4$ produced in the furnace is discharged with the ash, or regenerated to CaO for reuse in the fluidized-bed. Information is presented on work in the reporting period including; component testing in a 9 sq. ft. hot model, cold model testing; boiler construction; selection of subcontractors; steel erection for boiler; auxiliary system erection. Activities of FWEC and Champion relative to this program are also described.

6534 (FE—1237-43) **Multicell fluidized bed boiler design, construction, and test program: fluidized bed boiler cold modeling. Final report.** (Pope, Evans and Robbins, Inc., New York (USA). Combustion Systems Div.). Sep 1975. Contract EX-76-C-01-1237. 303p. Dep. NTIS, PC A14/MF A01.

Research efforts in cold modeling of the fluidized bed boiler are described. These efforts have concentrated on the quality of fluidization and material handling. The areas studied were: air distributor plate design, horizontal tube bundle arrangement, fuel injection, bed renewal, localized fluidization and flyash injection.

6535 (FE—1237-51) **Multicell fluidized-bed boiler design, construction, and test program. Quarterly progress status report, January—March 1976.** Mesko, J.E. (Pope, Evans and Robbins, Inc., New York (USA)). Apr 1976. Contract EX-76-C-01-1237. 70p. Dep. NTIS, PC A04/MF A01.

The objective of this program is to design, construct, and test a multicell fluidized-bed boiler, as a pollution-free method of burning high-sulfur coal, or burining highly corrosive coals without excessive maintenance problems, with an approximate steam generating capacity of 300,000 pounds per hour. Steam pressure and temperature conditions are selected to meet requirements of the site at which the boiler is being installed.

6536 (FE—1237-63) **Multicell fluidized-bed boiler design, construction and test program. Quarterly progress status report, October—December 1976.** Mesko, J.E. (Pope, Evans and Robbins, Inc., New York (USA). Combustion Systems Div.). Jan 1977. Contract EX-76-C-01-1237. 96p. Dep. NTIS, PC A05/MF A01.

The objective of the program is to design, construct and test a multicell fluidized-bed boiler as a pollution-free method of burning high-sulfur coal or burning highly corrosive coals without excessive maintenance problems. The fluidized-bed boiler will provide approximately 300,000 pounds of steam per hour. Steam pressure and temperature conditions were selected to meet requirements of the site at which the boiler is being installed.

6537 (FE—1237-67) **Multicell fluidized-bed boiler design, construction, and test program. Quarterly progress status report, January—March 1977.** Mesko, J.E. (Pope, Evans and Robbins, Inc., New York (USA). Combustion Systems Div.). Apr 1977. Contract EX-76-C-01-1237. 79p. Dep. NTIS, PC A05/MF A01.

The objective of the program is to design, construct and test a multicell fluidized-bed boiler as a pollution-free method of burning high-sulfur coal or burning highly corrosive coals without excessive maintenance problems. The fluidized-bed boiler will provide approximately 300,000 pounds of steam per hour. Steam pressure and temperature conditions were selected to meet requirements of the site at which the boiler is being installed.

6538 (FE—2556-05) **Development of a ceramic tube heat exchanger with relaxing joint. Monthly technical progress report, May 1—June 1, 1977.** Ward, M.E.; Napier, J.C. (Solar, San Diego, Calif. (USA)). 15 Jun 1977. Contract EF-77-C-01-2556. 25p. Dep. NTIS, PC A02/MF A01.

All fixtures needed to perform the Materials Evaluation have been fabricated. Tests will start as soon as ceramic specimens are received from vendor. The environmental rig has been fabricated. It will be installed in the test facility next week and calibration tests will be started. Six glass candidates have tentatively been selected to meet engineering requirements established for the low and moderate relaxation joint temperature ranges. The glass viscosity-temperature characteristics will be classified next month. The joint relaxation computer program has been completed. Parametric analysis along with relaxation joint design will start next month. Preliminary design analysis has shown the preheat of a relaxation joint to be a viable and practical method for relieving cold start thermal transient stress buildup in the header/tube system. Although the relaxing joint heat exchanger is considered the primary design, other possible heat exchanger tube and shell systems are being evaluated as alternatives.

6539 (FE—2556-08) **Development of a ceramic tube heat exchanger with relaxing joint. Monthly technical progress report, August 1—September 1, 1977.** Ward, M.E.; Napier, J.C. (Solar, San Diego, Calif. (USA)). 10 Sep 1977. Contract EF-77-C-01-2556. 18p. Dep. NTIS, PC A02/MF A01.

Ceramic tube delivery is delaying material strength evaluation tests and material-environmental interaction tests. High temperature strength tests (1204°C) were completed on KT silicon carbide tubes. Weibull Modulus of 11 was obtained with a mean strength of 124 MPA (18 ksi). Three distinct temperature zones were identified in tube rig tests for the Homer City power plant flyash; non-sticking, sticking and flyash melt-off. Results of flyash calibration tests performed on the environmental rig indicate that the proposed test conditions cannot be run due to heavy flyash accumulations in short time intervals. New conditions are recommended. A preliminary sketch of a counter-axial flow heat exchanger was completed.

6540 (ORNL/Sub—4484/5) **Estimate of costs of a fluidized bed steam generating plant.** (United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)). Jul 1977. Contract W-7405-ENG-26. 22p. Dep. NTIS, PC A02/MF A01.

The costs of a steam supply plant using an atmospheric fluidized bed (AFB) boiler designed for coal firing are estimated. The estimated costs consist of capital and operating and maintenance costs for a plant with one 250,000 pounds per hour AFB boiler unit producing steam at 650 psig and 750°F. The capital cost of this plant is very dependent on the site, application, and type of coal selected. The capital costs are about $60 to $70 per pound per hour of capacity for the single unit plant. Four unit plants can be expected to cost less, approximately $50 to $60 per pound per hour, because of the many systems which are common to all boilers. A summary of the single plant costs is provided. Operating and maintenance costs, excluding oil, were also prepared, and are tabulated. These also can vary widely, depending on the specific plant application. For this estimate, it was assumed that the steam plant would be staffed independently of adjacent process facilities.

6541 (ORNL/TM—6000) **Coal-fired alkali metal power system design study. Technical progress report, April 1, 1977—June 30, 1977.** Samuels, G. (Oak Ridge National Lab., Tenn. (USA)). Aug 1977. Contract W-7405-ENG-26. 32p. Dep. NTIS, PC A03/MF A01.

The report given is the third of a series of quarterly progress reports for the Coal-Fired Alkali Metal Power System Design Study. The effort during this quarter was devoted to the design and analysis of an atmospheric pressure fluidized bed furnace-boiler system for either cesium or potassium. The tasks receiving the most attention during this period were the selection and analysis of the basic plant arrangement, the design of the furnace-alkali metal boiler, and the analysis of the alkali metal condenser-steam boiler.

6542 Flow of two liquids in a helix: an analogue of high pressure helical boilers. Kubie, J.; Gardner, G.C. (Cent Electr Res Lab, Leatherhead, Surrey, Engl). *Int. J. Multiphase Flow;* 3: No. 4, 353-366(Jun 1977).

A two-liquid system provides a better analogue for investigating certain aspects of high pressure boiler tube hydrodynamics than air and water at atmospheric pressure. A study is presented here of the flow of n-butyl acetate and water, and iso-amyl alcohol and water in helical coils and the general conclusion is that strongly stratified conditions of either completely separated phases or of drops of one phase in the other exist until velocities are high enough to produce drops sufficiently fine to be dispersed by the turbulence. The critical condition for the breakdown of the separated phases to produce drops is quantitatively correlated with the mass flowrates needed to avoid low quality dryout in both high pressure water and high pressure freon helical boilers.

6543 On the fluid-dynamic design of high-power steam turbines for thermal power plants. Bonzani, G.; Martelli, F.; Senis, R. (Soc Gen Elettromec, Genova, Italy). *Termotecnica [Milan];* 31: No. 5, 250-260(May 1977). (In Italian).

The methodology followed for the fluid-dynamic design of steam turbines is outlined and the essential equations are reported. After describing the calculational methods employed for thermodynamical stage design, the results obtained from the application of such methods to high-power turbines design are shown. Finally, some of the main criteria adopted for the design of turbine blades are mentioned.

6544 Selection of optimal characteristics of the elementary turbine stage with set values of u/C/sub o and C/sub z/. Boiko, A.V.; Govorushchenko, Y.N. (Khar'kov Polytech Inst im. V.I. Lenin, Ukr SSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 5, 65-70(May 1977). (In Russian).

Formulas are obtained permitting optimal (from the point of view of maximum efficiency) characteristics of an axial turbine stage to be plotted for a wide range of variation of the parameters v=u/C/sub o/ and c/sub z$ (flowrate coefficient). It is shown that the presence of losses in the stator and rotor blades and their ratio have a considerable effect on the value and character of the flow twist after the rotor. The flowrate coefficient c/sub z/ has a substantial effect on optimal parameters. Given a set constant value, a maximum of optimal values of stage efficiency is observed. With the rise of the flowrate coefficient, it displaced towards lower values of u/C/sub o/ and of the degree of reactivity.

6545 Steam trap maintenance. Laidley, C.W. (DuPont of Can Ltd, Maitland, Ont). *Energy Process.;Can.;* 69: No. 4, 26-28(Mar-Apr 1977).

A maintenance program, set up by DuPont of Canada at its Maitland, Ontario, steam generating plant to demonstrate that small energy savings add up to big dollar savings and increased operating efficiency is described. The program established that most the plants steam losses from defective traps could recovered through an ongoning maintenance program. Results obtained to date under the trap maintenance program are discussed.

6546 Steam turbine applications. Mabbott, L.A. (Westinghouse Can Ltd, Hamilton, Ont). *Energy Process.;Can.;* 69: No. 4, 30-32, 34(Mar-Apr 1977).

Although the basic fundamentals of steam design have not changed over the past 80 years, there have been many improvements and refinements in design such that the current state of the art others many options in selecting a steam turbine for a given application. With this in mind, effective uses of the steam turbine as it relates to energy conversion and energy conservation are considered. The potential areas of improvements in plant efficiency, reduction of costs and, as a main benefit, the conservation of energy, are pinpointed. These include the selection of the suitable geometry of a steam turbine for a specific application, pressure reduction, use of waste steam and proper use of control devices.

6547 Development and investigation of a steam and water tract scheme using separators in the cross-cut of the lower radiant part. Kopeliovich, A.M.; kaibullin, I.Kh.; Pavlenko, L.I.; Novikov, B.E.; Kamenetskii, B.Y.; Shchukin, E.M.; Besedin, A.M.; Myakao, V.I.; Buchis, S.V.; Spudulis, V.I. (Energ Inst im. G.M. Krzhizhanovskii, USSR). *Energomashinostroenie;* No. 4, 3-5(1977). (In Russian).

Results of laboratory investigations and industrial tests of separators installed on a TGMP-114 boiler of a 300 MW unit of the Lithuanian district power station are presented. The fractional composition of iron oxides and specific features of its determination in boiler water samples by the method of accumulation on filters are described.

6548 Improvement of the quality of machining of turbine parts. Lekhtman, A.P. (Leningrad Met Plant, USSR). *Energomashinostroenie;* No. 4, 25-26(1977). (In Russian).

Specific features of machining of turbine components of nonrigid construction, contributing towards a higher precision of machining and surface quality, are considered. Examples of machining methods and measures to minimize or allow for the deformation of parts in the process of machining and assembly are presented. Designs of arrangements used for this purpose at Leningrad Metal Works to machine cylinders, sealing rings, and other turbine components are described.

6549 Results of industrial application of wound (profiled) tubes in PT-25-90/10 turbine condenser of no. 7 heat-and-power plant of leningrad power system. Bogolyubov, Y.N.; Gambaryants, L.A.; Girgor'ev, G.V.; Derevyanko, A.S.; Petrushin, E.D. (Cent Sci Res Boiler and Turbine Inst, USSR). *Energomashinostroenie;* No. 4, 35-36(1977). (In Russian).

Improved efficiency of wound (profiled) tubes with spiral knurling, compared with smooth tubes, in condensers of high-capacity steam turbines is noted.

6550 Selection of the design scheme of flange joints of hydraulic turbine shafts. Bugov, A.U. (Leningrad Mach Plant, USSR). *Energomashinostroenie;* No. 4, 39-41(1977). (In Russian).

A comparative analysis of known design schemes and results of an extensive experimental investigation of the stressed and strained state of flange joints of hydraulic turbine shafts are presented. 9 refs.

6551 Calculation of tube walls subjected to axisymmetrical loads. Kostyuchenko, A.A. *Energomashinostroenie;* No. 4, 41-43(1977). (In Russian).

A method and formulas for designing tube walls subjected to axisymmetrical loads are presented.

6552 Optimal ratio of velocities for a turbine stage allowing for losses in the radial gap. Babot, S.V.; Babot, F.N. (Kaluga Turbine Plant, USSR). *Energomashinostroenie;* No. 4, 46-47(1977). (In Russian).

A relation is presented permitting determination of the effect of the energy loss in the radial gap on the optimal ratio of velocities of a turbine stage without a shroud, with an arbitrary degree of ractivity on the mean radius. Results of calculations according to the proposed relation are compared with experimental data obtained by different authors.

6553 Theoretical analysis of operating conditions of superheaters, accounting for nonuniformity of the temperature field of combustion products. Reznik, N.I. *Energomashinostroenie;* No. 5, 9-10(1977). (In Russian).

Problems of differentiated calculation of the coefficients of nonuniformity of heat reception in particular elements of successive stages of the superheater of a high-capacity boiler, taking account of the local gas temperature values in the zone in question, are considered. Different operating conditions are analyzed.

6554 Optimization of kinematic characteristics of the three-dimensional flow in the last stages of high-capacity steam turbines. Shubenko-Shubin, L.A.; Antiptsev, Y.P. (Inst of Probl Mech, Acad of Sci of the Ukr SSR). *Energomashinostroenie;* No. 5, 11-13(1977). (In Russian).

A variational problem of optimization of the kinematic characteristics of the three-dimensional flow in the gaps of the last stage is solved.

6555 Effect of gas parameters in disk chambers on axial force in a turbine section. D'yakonov, R.I.; Drokonov, A.M.; Lukashevich, V.E.; Sivaev, V.M. (Bryansk Inst of Transp Mach, USSR). *Energomashinostroenie;* No. 5, 13-15(1977). (In Russian).

Experimental data on the effect of the character of flow in the frontal and rear chambers of a disk on the axial force in the turbine stage are given.

6556 Improvement of design as a powerful reserve of intensification of production. Bauman, N.Y.; Osipenko, V.N.; Kuzyushin, V.K.; Shklyar, A.I. (Ural Polytech Inst im. S.M. Kirov, USSR). *Energomashinostroenie;* No. 5, 33-35(1977). (In Russian).

The expedience of utilizing cold-rolled sectional blanks for the manufacture of constant-section rotor blades designed integral with the intermediate body is considered. The blanks consist of sectional strips with one side coinciding with the inner surface of blades, with only outer surface to be machined later.

6557 (ERDA-tr—319) **Development progress and possible applications of the fluidized bed furnace.** Jahkola, A. Translated from *Energ. Tech.;* 27: No. 4, 142-148(1977). 13p. Dep. NTIS, PC A02/MF A01.

The development of fluidized bed combustion as well as the goals of development projects for commercial generation of heat and electric power are reviewed. The results show that it is unclear at this time which direction the development of the fluidized bed combustion will take and what its future is in general. The first large-

scale projects are now at a stage that will require a decision for the future. Results obtained and preliminary calculations concerning the cost effectiveness of fluidized bed combustion indicate that the process might become an economical, environmentally acceptable system that will permit us to use poorer quality inexpensive primary energy sources.

ECONOMICS

REFER ALSO TO CITATION(S) 6971, 6972

OFF-PEAK ENERGY STORAGE

REFER ALSO TO CITATION(S) 6815

FUELS

REFER ALSO TO CITATION(S) 5880

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 5826, 5841, 5842, 5885, 6873, 7380, 7422, 7464

THERMAL EFFLUENTS

REFER ALSO TO CITATION(S) 6522

6558 **River water temperature assessment methods applied to the River Sambre.** Gaspar, S.; Sine, L.; Gorlier, F. (Fac des Sci Agron de l'Etat, Gembloux, Belg). *Trib. CEBEDEAU;* **29**: No. 393-394, 285-301(Aug-Sep 1976). (In French).

Theoretical model is presented based on calorific values per unit of horizontal surface, longitudinal dispersion coefficient, and average depth of river. Heat flux is estimated according to means of values and compared with experimental data. Effects of power plants cooling water discharge on temperature fluctuation are considered. 11 refs.

NOXIOUS GAS AND PARTICULATE ABATEMENT AND CONTROL

REFER ALSO TO CITATION(S) 6533, 7054

6559 (EPRI-FP—291(Vol.2)) **Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report.** Schwab, J.; Goodson, D.; Cooper, J.; Ehlenberger, R.; Milovsoroff, P. (Air Pollution Systems, Inc., Seattle, Wash. (USA)). Oct 1976. 356p. Dep. NTIS, PC A16/MF A01.

This work was directed at developing more effective electrostatic precipitation of fine particulate, particularly of high resistivity fly ash, by imposing a higher degree of charge on the particles. A unique electrode assembly results in an intensely ionized flue gas which leads to a particle charge as high as four times greater than is currently being achieved. Such an ionizer would be the first or charging stage of an improved two-stage power station electrostatic precipitator immunized against high resistivity dust. Generally, laboratory analyses and testing have provided the data necessary to proceed with the design of a larger scale field pilot. Economic evaluations of the concept based on laboratory data are included. The evaluations indicate potential cost savings on new systems and retrofit upgrades. Possible mechanical arrangements for incorporating the high intensity ionizer into conventional design precipitators are indicated for both new and retrofit installations. Small scale field pilot work was undertaken at an operating utility to supplement laboratory work.

6560 (FE—2579-8) **Granular bed filter development program monthly report for July 1977.** Phillips, K.E. (Combustion Power Co., Inc., Menlo Park, Calif. (USA)). Aug 1977. Contract EF-77-C-01-2579. 14p. Dep. NTIS, PC A02/MF A01.

This is an intensive program to determine the scientific principle upon which granular-bed filtration operates and to design and construct a Granular-Bed Filter (GBF) device which can be subjected to controlled cold-flow testing for verification of these principles. The objective is to generate the desired information on the cold-flow model for future application, correlation, performance prediction, and implementation on a second generation GBF hot-flow model. The scope of the cold-flow program incorporates; theoretical analysis, in which the theories and mechanisms of the interaction of exhaust gases and granular media are studied and commuted to mathematical expressions for computer simulation; design and construction of the cold-flow model for parametric testing and correlation with the math model; installation of a particle injection and sampling facility to enable controlled dust injection, particle sampling and analysis, and filter performance determination, and; evaluation of filter screen decomposition phenomena and the effectiveness of various deposit-removing devices. The following topics are discussed: the activities performed in refining the filter computer simulation model; further classificaton of controls effected for injected dust particle sizing and distribution; a discussion of the refractory lining erosion experienced in the upper fluid bed cleaning vessel and corrective actions taken; a discussion of completion of 35 out of 104 scheduled tests to date; and, a summation of post-test investigations conducted relative to the front-face cleaning task.

6561 **Emission of nitrogen oxides from steam generators of thermal electric power stations.** Kalev, I. *Int. Chem. Eng.;* **17**: No. 3, 484-487(Jul 1977).

Translated from Khim. Kindustriya; 48: No. 1, 27-30(1976).

The formation of nitrogen oxides (mainly NO, with some NO_2) during combustion of various fuels in large steam boilers is reviewed, and a number of methods for reducing the formation and emission of NO/sub x/ are discussed. Test results are presented for some cases.

SITE SELECTION AND LAND USE

REFER ALSO TO CITATION(S) 6963, 6973

POWER TRANSMISSION AND DISTRIBUTION

REFER ALSO TO CITATION(S) 6969, 7002

6562 (EPRI-EL—484) **Power system dynamic analysis: Phase I. Final report.** Dembart, B.; Erisman, A.M.; Cate, E.G.; Epton, M.A.; Dommel, H. (Boeing Computer Services, Inc., Seattle, Wash. (USA). Energy Technology Applications Div.). Jul 1977. 164p. Dep. NTIS, PC A08/MF A01.

The models required for power system dynamic analysis are continually growing larger and more complex as power system interconnections are growing more significant. The purpose of this research is to improve both the efficiency and reliability of today's simulation, and to lead to a capability to perform the more complex simulation of tomorrow. The approach taken was to identify the fundamental characteristics of dynamic power system models, and to relate these to candidate numerical methods. The performance characteristics of the methods were analyzed for efficiency, reliability, and stability. Finally, extensive testing was performed on selected test cases (smaller cases were tested first, with testing on larger cases now proceeding) to identify the best computational procedures for solving power system dynamic problems. A diagnostic transient stability program has been developed to perform this testing. This program not only performs transient stability computation, but also analyzes the performance of the numerical methods. The diagnostic program, developed entirely on this research project, is presently being documented for use by other researchers. Conclusions of this first phase include specific recommendations of integration methods, step size requirements, and algebraic solution methods which will provide the basis for a new industry standard transient stability program. Recommendations are also included that will be useful for improving the efficiency and reliability of existing stability codes with minimal changes required.

6563 (NUREG—0316) **Alternative electrical transmission systems and their environmental impact.** Schiefelbein, G.F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1977. 138p. (BNWL—1774). NTIS $6.00.

A general description is provided of electrical transmission systems as an aid in determining their environmental impacts. Alternating current, direct current, overhead systems, underground systems, and water crossings are treated. The cost, performance, reliability, safety, and environmental impact of these systems are compared.

6564 (SAND—77-0799C) **Insulator surface charging during fast pulsed surface flashover in vacuum.** Anderson, R.A.; Brainard, J.P. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 9p. (CONF-771028—2). Dep. NTIS, PC A02/MF A01.

From Conference on electrical insulation and dielectric phenomena; Schenectady, New York, USA (17 Oct 1977).

The fact that charges accumulate on the surface of an electrically stressed insulator in vacuum is well established, but the rate of charging is not, and the role of this charge in surface flashover is controversial. Previous investigations support the hypothesis that charging proceeds very rapidly by means of an avalanche of electrons released from the insulator surface by secondary emission and that the avalanche is responsible for establishing the discharge channel in cathode-initiated surface flashover. In the experiments, insulators were subjected in vacuum (10^{-3} to 10^{-4} Pa pressure) to high-

voltage steps having 3 ns risetime. Measurements of the current of electrons arriving at the anode electrode at the edge of a 20 mm long, rectangular insulator verified that a secondary electron emission avalanche occurs on the insulator surface prior to breakdown, even for voltage pulses lasting only a few nanoseconds. In addition, the critical electric field angle associated with the equilibrium surface charge was determined under fast pulsed conditions, and found to agree well with the dc measurements of Boersch, et al. (LCL)

6565 (SAND—77-0809C) **Electron trajectories in the avalanche process.** Brainard, J.P.; Anderson, R.A. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 9p. (CONF-771028—1). Dep. NTIS, PC A02/MF A01.

From Conference on electrical insulation and dielectric phenomena; Schenectady, New York, USA (17 Oct 1977).

Surface flashover on solid insulators is an important breakdown mechanism in vacuum. It is believed that an electron avalanche, which occurs prior to flashover, plays a role in the breakdown mechanism. The avalanche involves electron multiplication on the insulator surface via secondary emission. Boersch, et al. have studied insulator surface charging by secondary emission, but a detailed analysis of the avalanche process is lacking. The trajectories of electrons emitted from an insulator under electrical stress in vacuum were calculated as a first step toward time-dependent numerical simulation of a secondary electron emission avalanche. Results indicate that most of the electrons strike the insulator at shallow angles of incidence with respect to the plane of the insulator surface, and that the angle of incidence depends on the incident energy when the space charge sheath of electrons above the insulator surface is taken into consideration.

6566 **Probability of random coincidences of short circuits in time.** Baev, A.V.; Kudin, V.G. (Novocherkassk Polytech Inst im. S. Ordzhonikidze, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 3, 49-55(Mar 1977). (In Russian).

Formulas are obtained permitting calculation of the probability of random coincidences of short circuits in time and the average length of intervals between these coincidences on condition that the moments of origin of these short circuits in the network form a Poissonian flow. A method of taking into account the effect of thunderstorm phenomena on this probability is presented. This effect is very substantial in networks with aerial power lines. 10 refs.

6567 **Powers in a tri-phase system operating in a distorting state.** Antoniu, I.S.; Gafencu, M. (Inst Polytech de Bucarest, Rom). *Rev. Roum. Sci. Tech., Ser. Electrotech. Energ.;* **22**: No. 1, 3-9(Jan-Mar 1977). (In French).

Using the tensorial calculus, the expressions of the active, reactive and distorting powers in the case of a distorting state balanced tri-phase system are established. An expression is derived for the distorting power of a tri-phase system. This distorting power is smaller than the algebraic sum of the distorting powers of each of the three phases. The same conclusion follows about the apparent power in a distorting state balanced tri-phase system.

6568 **Optimal decentralized regulators for load frequency control--1. interconnected power systems and load disturbances models.** Cautis, D.; Popeea, C. (Polytech Inst, Bucharest, Rom). *Rev. Roum. Sci. Tech., Ser. Electrotech. Energ.;* **22**: No. 1, 117-124(Jan-Mar 1977).

A new approach in designing linear decentralized regulators for load frequency control of interconnected power areas is presented. Simple models for interconnected power systems and load disturbances are derived.

AC SYSTEMS, EHV AND UHV

6569 (CONS/2063—1) **Dynamic load model study for overhead transmission lines. Final report, November 1975—September 1976.** Richardson, A.S. Jr. (Research Consulting Associates, Lexington, Mass. (USA)). Sep 1976. Contract EX-76-C-01-2063. 120p. Dep. NTIS, PC A06/MF A01.

A study was undertaken to examine by scale models the dynamic longitudinal loadings on flexible transmission structures. In the course of the investigation certain new concepts have also been developed concerning the elements of a transmission line system which contributes to the local flexibility of individual structures. Further, new methods of analysis were devised for the future use by designers in this field. These model test results have demonstrated that it is possible to simulate a number of dynamic loading conditions on a scale model of an actual transmission line system, taking into account a large number of variables, and producing results having direct interpretation at full scale. The method appears to be particularly useful in identifying any potential "trouble areas" in an existing design such as the use of horizontal struts on light angle structures, and/or adequacy of fatigue strength under galloping conditions. The effect of the higher stiffness is pronounced, being almost twice the loading under galloping conductor on the stiffer structure for short insulators. The most startling comparison however, was for long insulators. Here, the combined effect of higher stiffness and horizontal strut restraint leads to galloping loads which are between 4 and 5 times higher on the stiffer structure. Further, the galloping static wire loads are about $^2/_3$ of the static wire initial tension. This is considered to be a significant finding, and may bring serious concern to designers.

6570 (CONS/2107—1) **Sampling plans for lightning surges test program. Final report, May 1976—January 1977.** (Faucett (Jack) Associates, Inc., Chevy Chase, Md. (USA)). Mar 1977. Contract EX-76-C-01-2107. 147p. Dep. NTIS, PC A07/MF A01.

Results are presented of a study undertaken to determine how to measure and evaluate lightning-induced surges on power distribution lines. The study centered on the following basic tasks: prediction of ligntning phenomena; selection and characterization of instrument placement sites; determination of appropriate number of instruments; determination of instrument storage and data collection requirements; and recommendations for future efforts. It was concluded that 400 lightning surge recorders are needed for accummulating basic test data; 250 additional instruments are recommended for obtaining supplementary data; the instruments should be placed throughout the US with careful control of site selection and instrument installation; each instrument should be able to store one year's data; and this proposed field study is only the first step in achieving an understanding of the lightning protection cost-benefit problem. (LCL)

6571 (EPRI-EL—520) **SF_6 foamed insulation. Final report.** Giessner, B.G. (Gould, Inc., Colmar, Pa. (USA). Research and Development Div.). Aug 1977. 89p. Dep. NTIS, PC A05/MF A01.

Sulfur hexafluoride (SF_6) epoxy foam, a novel material which consists of a highly electronegative gas (SF_6) confined in a network of closed epoxy cells is described. SF_6 epoxy foam can be prepared by mixing liquid epoxy and molecular sieves that have been previously loaded with SF_6 (molecular sieves adsorb approximately 25% by weight SF_6). When the mix is heated, the molecular sieves release their adsorbed SF_6, thus foaming the epoxy. Subsequent cure traps the SF_6 in small, evenly distributed closed cells. Some of the measured properties of SF_6 epoxy foam indicate this unique material is suitable for high voltage electrical insulation. These properties include a low dielectric constant, a high dielectric strength, the ability to regain dielectric strength when punctured (by a low power source), and a material that does not require vacuum casting. Since some of these properties can be directly attributed to SF_6, an analytical method was developed to determine if epoxy foams retained the SF_6 blowing agent. Neutron Activation Analysis (NAA) was the chosen non-destructive method. Consequently, after measuring a sample's initial SF_6 concentration, the sample could be aged and reanalyzed in order to measure changes in SF_6 content due to aging. The NAA data obtained on aged samples indicated that some materials retained SF_6 up to the point of thermal decomposition, whereas other formulations retained SF_6 provided they were not aged in excess of their glass transition temperatures. The retention of SF_6 by these foams suggests they will retain the properties attributed to SF_6 and they can therefore be used as high voltage insulation in either air of SF_6 environments.

6572 (EPRI-EL—545) **Computer program for determination of earth potentials due to faults or loss of concentric neutral on URD cable.** Joy, E.B.; Nunnally, H.N. (Georgia Inst. of Tech., Atlanta (USA). School of Electrical Engineering). May 1977. 118p. Dep. NTIS, PC A06/MF A01.

Extruded solid dielectric cables with bare concentric neutral wires have received wide industry acceptance for underground residential distribution primary construction. The performance of this type of cable has been outstanding since the early 1960's. However, incidences of corrosion of the bare copper concentric neutral wires have caused the utilities to consider methods of mitigating the corrosion process. One viable method to control the corrosion is to apply an appropriate semiconducting or insulating jacket over the neutral wires. However, the effects of the jackets on "touch and step" potentials during short-circuits was not known. A research program was undertaken to develop a general computer program to calculate "touch and step" potentials, using the Franksville, Wisconsin Test Data as a basis for verifying the program. An additional objective was to compute earth surface potentials resulting from operation with an open neutral. The basic approach to the calculation of "touch and step" potentials is to isolate a section of cable of arbitrary length. A distributed parameter model is used to represent this cable section, the surrounding soil and supplemental grounding within the section. An equivalent circuit is employed to represent the remainder of the electrical system. The calculation of the "touch and step" potentials involves the solution of sets of simultaneous equations for the isolated section and Kirchoff's equations for the external equivalent circuit.

6573 **Design and development of a high voltage system operating simulator at E.D.F.** Molle, M.; Raczy, L.; Raguin, G. (Electr de Fr). *Rev. Gen. Electr.;* **86**: No. 1, 35-44(Jan 1977). (In French).

E.D.F. has built a network simulator intended for carrying out routine operations for the training of its operating staff. After a presentation of this simulator both with regard to its general design and use, the article describes the data processing solution which has been retained (basic design, hardware environment, programming). The paper finishes with the conclusions which can be drawn from the first operating year.

NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 6897

6574 (BQ-TOP—1(Rev.2A)) **Bechtel quality assurance program for nuclear power plants.** (Bechtel Power Corp., San Francisco, Calif. (USA)). Jul 1977. vp. Power Corp., San Francisco, CA.

The document describes the Bechtel Quality Assurance Program plan for use by the Bechtel Organization during the design, procurement and construction of nuclear power plants. The Program plan meets the requirements of the Nuclear Regulatory Commission Regulation 10 CFR 50 Appendix B.

6575 (COO/4121—1) **Delays in nuclear power plant construction. Progress report, September 15, 1976—September 14, 1977.** Mason, G.E.; Larew, R.E. (Ohio State Univ., Columbus (USA)). 10 Aug 1977. Contract EY-76-S-02-4121. 491p. Dep. NTIS, PC A21/MF A01.

This report identifies barriers to shortening nuclear power plant construction schedules and recommends research efforts that should minimize or eliminate the identified barriers. The identified barriers include: (1) design and construction interfacing problems; (2) problems relating to the selection and use of permanent materials and construction methods; (3) construction coordination and communication problems; and (4) problems associated with manpower availability and productivity;

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, BOILING WATER COOLED

REFER ALSO TO CITATION(S) 6636, 6677, 6720, 6788, 6789, 6795, 6796, 6799, 6801, 6808, 6811

6576 (BNL-NUREG—22866) **Anticipated corrosion in the Vermont Yankee spent fuel pool.** Weeks, J.R. (Brookhaven National Lab., Upton, N.Y. (USA)). Jun 1977. Contract EY-76-C-02-0016. 13p. Dep. NTIS, PC A02/MF A01.

The report provides additional information relating to a proposed modification to the spent fuel pool at the Vermont Yankee Nuclear Power Station (VYNPS) and addresses corrosion of spent fuel pool storage materials and zircaloy, and provides an analysis of the effectiveness of the Boral sealing.

6577 (NEDC—13461) **Contribution of fuel rod deposits to the buildup of radiation on out-of-core surfaces of the Nine Mile Point 1 BWR.** Blok, J.; Younger, J. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Mar 1977. 47p. Electric Co., San Jose, CA.

A mathematical model for predicting the long-term buildup of activity on out-of-core surfaces of the Nine Mile Point 1 boiling water reactor is described. Future work required to modify the model for use with other plants is discussed. The model conservatively overpredicts the contribution of deposits on fuel rods to the buildup of activity. Methods of refining the model are discussed.

6578 (NEDO—21488) **Examination of the failed feedwater sparger from Humboldt Bay 3: 1976 outage.** Cutt, J.C. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Nov 1976. 51p. Electric Co., San Jose, CA.

During the scheduled refueling and maintenance outage which began in July 1976 an underwater examination of vessel internals by closed circuit television discovered cracks in the feedwater sparger thermal sleeve and at the edge of the thermal sleeve to sparger weld. Apparent cracking was also detected around some of the sparger outlet holes. The sparger and thermal sleeve were later removed from the vessel and visually examined in detail. Portions of the sparger and thermal sleeve were selected and shipped to the Vallecitos Nuclear Center for a laboratory examination to determine the failure mechanism. This was the first occasion on which a comprehensive television examination of the sparger had been made. The plant has been in service since April 1963.

6579 (NP—22399) **Mark I Containment Program: Program Action Plan. Revision 2.** (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). 1 Aug 1977. vp. Electric Co., San Jose, CA.

The Program Action Plan presented provides a detailed description of project management information in an integrated format for the Mark I Containment Program. The Program Action Plan defines the objectives of the Program, gives Program task descriptions and displays the integration of the activities leading to a definition of loads for final reevaluation of the containment structure by the individual licensees. The report includes, for reference purposes, a brief summary of the historical background related to the reevaluation program for Mark I Containments.

6580 (ORNL/NUREG/TM—144) **Design criteria for piping and nozzles program quarterly progress report for October—December 1976.** Moore, S.E.; Bryson, J.W. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 24p. Dep. NTIS, PC A02/MF A01.

Short summaries are given for studies completed and reports published during the quarter including dimensional controls for piping products, combined loadings on ANSI B16.9 tees, and stresses at reinforced nozzles in spherical shell structures. A summary status report is also given for work currently in progress on the finite element analysis of isolated and closely-spaced nozzles in cylindrical pressure vessels. Finally, a summary report is given on the ASME Code and PVRC committee work including the current status of proposed Code rules revisions that are based, at least in part, on work conducted under the ORNL Design Criteria Program.

6581 **Spearator-superheaters for nuclear power plants with water-cooled reactors.** Andreev, P.A.; Artemov, L.N.; Bakanov, A.F.; Bilyaevskii, A.A.; Bushler, I.S.; Zozulya, N.V.; Manaenkov, V.N.; Sorokin, Y.L.; Fadeev, E.A. (Cent Sci Res Boiler and Turbine Inst, USSR). *Energomashinostroenie;* No. 5, 22-24(1977). (In Russian).

The design description and technical characteristics of SPP-220 (the variant with smooth tubes), SPP-220 and SPP-220M (variants with finned tubes), SPP-1000, SPP-500-1, and SPP-750 superheaters made at the Ordzhonikidze Works are presented. These separators-superheators are destined for turbines made at Kharkov Turbine Works and installed at nuclear power plants with water-cooled reactors.

6582 **Clinton power station project.** Womeldorff, P.J. (Ill Power Co). *SAE Prepr.;* No. 770505, 5(1977).

The Clinton Power Station Project is described from the planning to the construction stage, which is now in progress. The earthmoving required, particularly by the powerplant's most unique feature, a 5000 acre cooling lake, is detailed. A rationale for selecting nuclear power for this station is also presented.

6583 **Fatigue crack propagation in neutron-irradiated ferritic pressure-vessel steels.** James, L.A. (Westinghouse Hanford Co., Richland, WA). *Nucl. Saf.;* **18**: No. 6, 791-801(1977).

The results of a number of experiments dealing with fatigue crack propagation in irradiated reactor pressure-vessel steels are reviewed. The steels included ASTM alloys A302B, A533B, A508-2, and A543, as well as weldments in A543 steel. Fluences and irradiation conditions were generally typical of those experienced by most power reactors. In general, the effect of neutron irradiation on the fatigue crack propagation behavior of these steels was neither significantly beneficial nor significantly detrimental.

6584 **Rig tests on hydromechanical thrust bearings for circulating pumps in atomic power stations.** Boyarko, N.N.; Val'chuk, V.K. *Russ. Eng. J.* [*Engl. Transl.*]: **56**: No. 5, 29-31(1976).

The test rig developed comprises the testing installation with an electric drive and an oil and water system, supplementary equipment, the necessary measuring equipment, and a power supply for the drives. A thrust bearing comprises pads, which are under a load when operating (working pads), to take up the axial thrust produced by the loading device and pads on the other size of the thrust plate, which are non-loaded under stationary conditions (aligning pads), to take up the force due to the rotor weight. The lubricant for the thrust bearing can be oil or even water. The supply of lubricant to the working and aligning pads is made via a chamber between the shaft and the inside surface of the pads. 5 refs.

6585 **Comparison of the radioactive contamination of coolant loops of water- and gas-cooled reactors.** Veselkin, A.P.; Kirillov, V.B.; Netecha, M.E.; Nikitin, A.V. *Radiats. Bezop. Zashch. AES;* No. 1, 206-215(1975). (In Russian).

Gas-cooled nuclear reactors are examined from the point of view of providing radiation arrangements that satisfy the health rules. The study is directly related to studying the activity structure of their primary coolant loops and to determining the radiation fluxes on the equipment during operation and after shut-down, the radioactive exhausts to the atmosphere, and also the consequences of an accidental loss of seal in the primary loop. Seven boiling water and pressurized water reactors were selected for comparison. Data are presented on the activity of the coolant and deposits on the

surfaces of the primary loop equipment. Data are also presented on the primary loop equipment of gas-cooled reactors, and information is presented on the typical isotopic composition and the specific radioactivity of the isotopes in the Dragon reactor. The specific activity of ^{60}Co in large-scale AES's is expected to be approximately (2 to 5) . 10^{-8} Ci/cm^2. For comparison, it is shown that the typical ^{60}Co activity of the surface deposits in water-cooled NR's is (0.6 to 2.0) . 10^{-5} Ci/cm^2. Data are presented on the specific activity and calculated dose of gamma-radiation from an "infinite" steel tube during NR operation.

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, NON-BOILING WATER COOLED

REFER ALSO TO CITATION(S) 6580, 6581, 6583, 6584, 6585, 6636, 6677, 6717, 6718, 6719, 6720, 6787, 6788, 6789, 6795, 6796, 6799, 6801, 6807, 6808, 6809, 6811

6586 (BAW—10083A(Rev.1)) **Babcock and Wilcox model for predicting in-reactor densification.** Buescher, B.J.; Pegram, J.W. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jul 1977. vp. and Wilcox, Lynchburg, VA.

The B and W densification model is based on a correlation between in-reactor densification and a thermal resintering test. The densification model has been found to predict in-reactor densification with a remarkable degree of accuracy for fuel pellets operated at heat rates above 5 kW/ft and with considerable conservatism for pellelts operating at heat rates below 5 kW/ft.

6587 (BMI-NUREG—1976) **Evaluating strength and ductility of irradiated zircaloy: Task 5. Quarterly progress report, April—June 1977.** Bauer, A.A.; Lowry, L.M.; Perrin, J.S. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1977. 45p. NTIS.

Three H. B. Robinson fuel rods were characterized by visual examination, gamma scanning, profilometry, eddy current inspection, and plenum-gas measurement. Fuel fission-gas releases of 0.19 to 0.25 percent were calculated. Oconee fuel rods were tensile tested to characterize rod-to-rod and specimen location differences in tensile properties. The only difference occurred at a peak burnup location along the fuel rod where a slightly higher than average strength was noted. Metallographic examination of possible defect areas as indicated by eddy-current inspection revealed no evidence of tube-wall defects. Tensile tests on Robinson cladding narrowed the temperature range over which the total elongation increases sharply, as the test temperature is increased, to temperatures between 650 and 700 F. Tensile tests of Oconee fuel-rod cladding show that the ultimate and yield strengths decrease linearly with temperature from room temperature to 800 F. The uniform elongation is unaffected by temperature, while total elongation is relatively level below 600 F and then increases gradually as the test temperature increases to 800 F. The yield strength increases slightly as the strain rate is increased from 0.0025 to 2.5 min^{-1} in tensile tests at 700 F. The ultimate strength increases and then levels off over the same range, while total elongation exhibits the inverse behavior. Uniform elongation shows no effect of strain rate. Tube wall-thickness and diameter measurements as a function of distance from the point of fracture in a tensile specimen have been made on irradiated-and-annealed H. B. Robinson cladding and an unirradiated Sandvik tube. The behavior of the more highly annealed material is similar to that of the unirradiated tubing.

6588 (COO—2477-5(Vol.1)) **Capital cost: pressurized water reactor plant. Commerical electric power cost studies.** (United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)). Jun 1977. Contract EY-76-C-02-2477. 428p. (NUREG—0241(Vol.1)). Dep. NTIS, PC A19/MF A01.

The investment cost study for the 1139-MW(e) pressurized water reactor (PWR) central station power plant consists of two volumes. This volume includes in addition to the foreword and summary, the plant description and the detailed cost estimate.

6589 (COO—2477(Vol.2)) **Capital cost: pressurized water reactor plant. Commercial electric power cost studies.** (United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)). Jun 1977. Contract EY-76-C-02-2477. 384p. (NUREG—0241(Vol.2)). Dep. NTIS, PC A17/MF A01.

The investment cost study for the 1139 MW(e) pressurized water reactor (PWR) central station power plant consists of two volumes. This volume contains the drawings, equipment list and site description.

6590 (COO—4039-1) **Plant systems/components modularization study. Final report.** (Stone and Webster Engineering Corp., Boston, Mass. (USA)). Jul 1977. Contract EY-76-C-02-4039. 270p. Dep. NTIS, PC A12/MF A01.

The purpose of the report is to summarize the final results of a Plant Systems/Components Modularization Study based on Stone and Webster's Pressurized Water Reactor Reference Design. To fully evaluate the practicability and desirability of the identified preassembly modules and recommend a basis for application to a new nuclear power plant, Stone and Webster has identified the Sundesert Nuclear Plant presently planned for southern California for possible implementation of modular construction techniques. The program has been modified to include evaluation of the most promising areas for modular consideration based on the level of the Sundesert project engineering design completion and the feasibility of their incorporation into the plant construction effort.

6591 (ORNL/Sub—4390/4) **400-MWe consolidated nuclear steam system (CNSS): 1200-MWt/conceptual design.** (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jun 1977. Contract W-7405-ENG-26-4390. 148p. (BAW—1445). Dep. NTIS, PC A07/MF A01.

A 1200-MWt consolidated nuclear steam system (CNSS) conceptual design is described. The concept, derived from nuclear merchant ship propulsion steam systems but distinctly different from those systems in detail, incorporates the steam generators within the reactor pressure vessel. This configuration eliminates primary coolant circulating piping external to the reactor pressure vessel since the primary coolant circulating pumps are mounted in the pressure vessel head. So arranged, the maximum piping break that must be assumed is that of the pressurizer surge line, which is substantially smaller than a primary coolant circulating line. A fracture of the pressurizer surge line would result in substantially lower mass and energy release rates of the primary coolant during the assumed loss-of-coolant accident. This in turn makes practical a pressure-suppression containment rather than the "dry" containment commonly used for pressurized water reactors.

6592 (TREE-NUREG—1074) **Irradiation Effects Test Series: Test IE-2. Test results report.** Allison, C.M.; Croucher, D.W.; Ploger, S.A.; Mehner, A.S. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1977. Contract EY-76-C-07-1570. 189p. Dep. NTIS, PC A09/MF A01.

The report describes the results of a test using four 0.97-m long PWR-type fuel rods with differences in diametral gap and cladding irradiation. The objective of this test was to provide information about the effects of these differences on fuel rod behavior during quasi-equilibrium and film boiling operation. The fuel rods were subjected to a series of preconditioning power cycles of less than 30 kW/m. Rod powers were then increased to 68 kW/m at a coolant mass flux of 4900 kg/s-m^2. After one hour at 68 kW/m, a power-cooling-mismatch sequence was initiated by a flow reduction at constant power. At a flow of 2550 kg/s-m^2, the onset of film boiling occurred on one rod, Rod IE-011. An additional flow reduction to 2245 kg/s-m^2 caused the onset of film boiling on the remaining three rods. Data are presented on the behavior of fuel rods during quasiequilibrium and during film boiling operation. The effects of initial gap size, cladding irradiation, rod power cycling, a rapid power increase, and sustained film boiling are discussed. These discussions are based on measured test data, preliminary postirradiation examination results, and comparisons of results with FRAP-T3 computer model calculations.

6593 (TREE-NUREG—1158) **Axial gas flow in irradiated PWR fuel rods.** Dagbjartsson, S.J.; Murdock, B.A.; Owen, D.E.; MacDonald, P.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1977. Contract EY-76-C-07-1570. 105p. Dep. NTIS, PC A06/MF A01.

Transient and steady state axial gas flow experiments were performed on six irradiated, commercial pressurized water reactor fuel rods at ambient temperature and 533 K. Laminar flow equations, as used in the FRAP-T2 and SSYST fuel behavior codes, were used with the gas flow results to calculate effective fuel rod radial gaps. The results of these analyses were compared with measured gap sizes obtained from metallographic examination of one fuel rod. Using measured gap sizes as input, the SSYST code was used to calculate pressure drops and mass fluxes and the results were compared with the experimental gas flow data.

6594 (WCAP—8576(Suppl.2)) **Augmented startup and cycle 1 physics program supplement 2.** Tuley, C.R.; Lucoff, D.M.; Doshi, P.K.; Demas, N.G.; Carlson, W.R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Aug 1977. vp. Electric Corp., Pittsburgh, PA.

In August 1975, WCAP-8575 was submitted to the Nuclear Regulatory Commission (NRC) to institute a systematic program of augmented Initial Startup Testing and Cycle 1 Physics Testing. This program was designed to address the Advisory Committee on Reactor Safeguards (ACRS) concerns with the then new Westinghouse PWRs, which were rated at higher power densities than operating Westinghouse reactors at that time. Since submittal of WCAP-8575, a supplement has been submitted which expands the data base for steady-state and transient conditions. That supplement also discussed

Westinghouse analysis methods as they related to the program. The purpose of the report presented is to provide additional information received from tests conducted at three four-loop plants. Three types of tests were performed with analysis of the corresponding data.

6595 (WCAP—8964) **Safety analysis for the revised fuel rod internal pressure design basis.** Risher, D.H. (ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Aug 1977. vp. Electric Corp., Pittsburgh, PA.

The safety implications of the proposed revision to the Westinghouse fuel rod internal pressure design basis have been investigated. The revised design basis was developed as a more realistic basis for satisfying stress/strain limits while increasing the flexibility of the designer and enhancing reactor operation capability in areas such as reduced pressure operation and cycle stretchout. As a result of the revised design basis, a small percentage of the fuel rods in the core are allowed to exceed the nominal coolant design pressure. The safety implications of the revised design basis were investigated using a conservative, bounding approach in order to make the results applicable to all present and future Westinghouse designed and fueled plants. The potential concerns, which were addressed during normal operation and accident conditions, are: fuel rod integrity, DNB propagation, and clad ballooning and degradation of heat transfer following DNB.

6596 (WCAP—9154) **414 integrated protection system prototype verification program.** Donnelly, J.A.; Edison, D.M.; Gallagher, J.M. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Aug 1977. vp. Electric Corp., Pittsburgh, PA.

The 414 Integrated Protection System Prototype Verification Program is a coordinated program to demonstrate the design objectives of the Westinghouse digital/analog protection instrumentation system, as described in RESAR-414. This topical report is organized into two major parts which establish the design principles and the verification program that will be used during the development, test and operation phases of the prototype model. Design principles sections are included for the propotype system, as well as its software and hardware. Items such as program administration, documentation, design and development, and verification principles are addressed in these sections. The discussions of the verification program is also similarly arranged for the prototype system, and its software and hardware. Items included within these sections are the program administration, verification methods, documentation, and acceptance criteria.

6597 **Subcooled boiling correlation for the thermal design of commercial steam generators.** Campolunghi, F.; Cumo, M.; Palazzi, G.; Urbani, G. (Com Naz Per l'Energia Nucl, CSN, Cassacia, Italy). *Termotecnica [Milan]*; **31**: No. 4, 185-194(Apr 1977).

The subcooled boiling region of commercial steam generators (with special reference to PWR steam generators) may be rather ample. Thus, its influence on the whole thermal design must be accurately evaluated. The present research provides design correlation in the subcooled boiling region for the heat transfer coefficient derived from full-scale tests. This means the correlation obtained is immediately applicable in industrial situation. Compared to existing correlations, the new one is simpler and easier to use. 18 refs.

6598 **Generation of traction current for the firt time in a nuclear power plant: the joint nuclear power plant i.** Lisson, P. (Dtsch Bundesbahn, Hamburg, Ger). *Elektr. Bahnen;* **48**: No. 3, 58-66(Mar 1977). (In German).

A 158-Mw railroad-owned 16-2/3 Hz turboset installed beside a three phase current generator in the joint nuclear power plant Neckar is for the first time generating traction current from nuclear energy. The article gives a survey on the layout and interaction of the most important components of the plant which is equipped with a pressurized water reactor (PWR). The operational possibilities of the power plant are described. 8 refs.

POWER REACTORS, NON-BREEDING, GRAPHITE MODERATED

REFER ALSO TO CITATION(S) 6585, 6795, 6798, 6810, 6812

6599 (BNL-NUREG—23228) **Nonlinear response of graphite structures.** Chang, T.Y.; Reich, M.; Suzuki, H. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 16p. (CONF-770929—11). Dep. NTIS, PC A02/MF A01.

From Seminar on HTGR safety technology; Upton, New York, USA (15 Sep 1977).

A nonlinear constitutive relation for graphite under three-dimensional stress states is presented for the finite element stress analysis. In the constitutive formulation, graphite is assumed to be transversely isotropic and an incremental stress-strain law is utilized in conjunction with a loading function which is used to specify the elastic or elastic-plastic state of deformations. The loading function is also used to define the strain-hardening of the material starting from the initial yielding state to the failure (or fracture) state. Therefore, by using this constitutive relation, not only the nonlinear load-deformation response of graphite is determined, but also its failure load and corresponding failure mode can be predicted.

6600 (GA-A—13452) **Postirradiation examination of Peach Bottom fuel test element FTE-4.** Wallroth, C.F.; Holzgraf, J.F.; Jensen, D.D.; Zumwalt, L.R. (General Atomic Co., San Diego, Calif. (USA)). Jul 1977. Contract EY-76-C-03-0167-017. 335p. Dep. NTIS, PC A15/MF A01.

The report presents the irradiation results and their evaluation for Peach Bottom fuel test element FTE-4. It describes in detail the efforts by General Atomic Company over the last two years to establish a system for extracting meaningful performance information from a fuel test element. This has been done with the goal of making direct comparisons between as-measured data and core design code predictions. Special emphasis has been placed on determining the 95% confidence limits on most of the preirradiation and postirradiation measurements in order to allow a better comparison with GAUGE, FEVER, and TREVER code calculations which are used in HTGR core thermal and mechanical design.

6601 (GA-A—13982) **Evaluation of carbon deposition and possible consequences in the HTGR: a review.** Gainey, B.W. (General Atomic Co., San Diego, Calif. (USA)). Jul 1977. Contract EY-76-C-03-0167-017. 140p. Dep. NTIS, PC A07/MF A01.

Reactions between gaseous impurities present in the HTGR helium coolant and steam generator materials are complex and incompletely understood. In particular, carbon deposition could have an effect on the performance of several components in the reactor circuit, but at present an assessment of the risk involved is prevented by insufficient data. This review highlights some of the areas where data and understanding are incomplete and defines a strategy for obtaining the required information.

6602 (GA-A—14147) **HTGR containment design options: an application of probabilistic risk assessment.** (General Atomic Co., San Diego, Calif. (USA)). Aug 1977. Contract EY-76-C-03-0167-051. 172p. Dep. NTIS, PC A08/MF A01.

Through the use of probabilistic risk assessment (PRA), it is possible to quantitatively evaluate the radiological risk associated with a given reactor design and to place such risk into perspective with alternative designs. The merits are discussed for several containment alternatives for the HTGR from the viewpoints of economics and licensability, as well as public risk. The quantification of cost savings and public risk indicates that presently acceptable public risk can be maintained and cost savings of $40 million can result from use of a vented confinement for the HTGR.

6603 (GA-A—14274) **STAT, GAPS, STRAIN, DRWDIM: a system of computer codes for analyzing HTGR fuel test element metrology data. User's manual.** Saurwein, J.J. (General Atomic Co., San Diego, Calif. (USA)). Aug 1977. Contract EY-76-C-03-0167-017. 217p. Dep. NTIS, PC A10/MF A01.

A system of computer codes has been developed to statistically reduce Peach Bottom fuel test element metrology data and to compare the material strains and fuel rod-fuel hole gaps computed from these data with HTGR design code predictions. The codes included in this system are STAT, STRAIN, GAPS, and DRWDIM. STAT statistically evaluates test element metrology data yielding fuel rod, fuel body, and sleeve irradiation-induced strains; fuel rod anisotropy; and additional data characterizing each analyzed fuel element. STRAIN compares test element fuel rod and fuel body irradiation-induced strains computed from metrology data with the corresponding design code predictions. GAPS compares test element fuel rod, fuel hole heat transfer gaps computed from metrology data with the corresponding design code predictions. DRWDIM plots the measured and predicted gaps and strains. Although specifically developed to expedite the analysis of Peach Bottom fuel test elements, this system can be applied, without extensive modification, to the analysis of Fort St. Vrain or other HTGR-type fuel test elements.

6604 (GA-A—14407) **Gas turbine and advanced HTGR materials screening test program: 10,000-hour results and semiannual progress report for the period ending March 31, 1977.** Rosenwasser, S.N.; Johnson, W.R. (General Atomic Co., San Diego, Calif. (USA)). Jul 1977. Contract EY-76-C-03-0167-046. 265p. Dep. NTIS, PC A12/MF A01.

Work on the Gas-Turbine and Advanced High-Temperature Gas-Cooled Reactor (HTGR) Materials Screening Test Program is documented. Emphasis is on the results and analyses of creep data to 11,000 hr and the detailed metallurgical evaluations performed on candidate alloy specimens tested for up to 10,000 hr. Long-term creep and unstressed aging data in controlled-impurity helium and in air at 650, 800, and 900°C are reported for the original alloys in the program, including the vacuum-cast Ni-base superalloys, IN 100, Rene 100, IN 713, MM 004, M 21, and IN 738; the wrought solid-

solution-strengthened Ni—Cr alloys, Hastelloy X and Inconel 617; the centrifugally-cast austenitic Fe—Ni—Cr alloy, IN 519; the oxide-dispersion-strengthened (ODS) Ni—Cr alloys, MA 753 and MA 754; and the wrought Mo-base alloy, MoTZM. Results at 650°C and 10,000 hr for the precipitation-strengthened alloys Inconel 718, Inconel 706, and A 286 are also included. Similar, but much shorter term data at 800, 900, and 1000°C for the recently added wrought alloys Hastelloy X (second heat), Hastelloy S, RA 333, and HD 556, and the additional centrifugally-cast alloys HK 40, Supertherm, Manaurite 36X, Manaurige 36XS, and Manaurite 900, are also reported.

6605 (GA-A—14418) **HTGR fuels and core development program. Quarterly progress report for the period ending May 31, 1977.** (General Atomic Co., San Diego, Calif. (USA)). Jun 1977. Contract EY-76-C-03-0167-017. 195p. Dep. NTIS, PC A09/MF A01.

The work reported includes studies of reactions between core materials and coolant impurities, basic fission product transport mechanisms, core graphite development and testing, the development and testing of recyclable fuel systems, and physics and fuel management studies. Materials studies include irradiation capsule tests of both fuel and graphite. Experimental procedures are discussed and data are presented.

6606 (GA-A—14606) **Low-enrichment and denatured (thorium) fuels for the HTGR: a status report.** Asmussen, K.E.; Baxter, A.M.; Carney, H.C.; Dahlberg, R.C.; Erlandson, O.D.; Goeddel, W.V.; Gulden, T.D.; Merrill, M.H.; Rode, J.S.; Turner, R.F. (General Atomic Co., San Diego, Calif. (USA)). Sep 1977. Contract EY-76-C-03-0167-017. 60p. Dep. NTIS, PC A04/MF A01.

Operation of HTGRs on proliferation-resistant low-enrichment and denatured (thorium) fuel cycles is both feasible and practical, based on extensive U.S. and European data, and these fuels can be effectively utilized in the first generation of commercial HTGRs. The status of development of these fuels is described. Their resource-efficiency and other benefits are discussed, and the remaining design and verification work that must be completed so that these fuels can be licensed for commercial use are identified.

6607 (ORNL—5183) **High-temperature gas-cooled reactor safety studies. Progress report for January 1, 1974—June 30, 1975.** Cole, T.E.; Sanders, J.P.; Kasten, P.R. (Oak Ridge National Lab., Tenn. (USA)). Jul 1977. Contract W-7405-ENG-26. 280p. Dep. NTIS, PC A13/MF A01.

Progress is reported in the following areas: systems and safety analysis; fission product technology; primary coolant technology; seismic and vibration technology; confinement components; primary system materials technology; safety instrumentation; loss of flow accident analysis using HEATUP code; use of coupled-conduction-convection model for core thermal analysis; development of multichannel conduction-convection program HEXEREI; cooling system performance after shutdown; core auxiliary cooling system performance; development of FLODIS code; air ingress into primary systems following DBDA; performance of PCRV thermal barrier cover plates; temperature limits for fuel particle coating failure; tritium distribution and release in HTGR; energy release to PCRV during DBDA; and mathematical models for HTGR reactor safety studies.

6608 (ORNL—5234) **ORR irradiation experiment OF-1: accelerated testing of HTGR fuel.** Tiegs, T.N.; Long, E.L. Jr.; Kania, M.J.; Thoms, K.R.; Allen, E.J. (Oak Ridge National Lab., Tenn. (USA)). Aug 1977. Contract W-7405-ENG-26. 71p. Dep. NTIS, PC A05/MF A01.

The OF-1 capsule, the first in a series of High-Temperature Gas-Cooled Reactor fuel irradiations in the Oak Ridge Research Reactor, was irradiated for more than 9300 hr at full reactor power (30 MW). Peak fluences of 1.08×10^{22} neutrons/cm^2 (> 0.18 MeV) were achieved. General Atomic Company's magazine P13Q occupied the upper two-thirds of the test space and the ORNL magazine OF-1 the lower one-third. The ORNL portion tested various HTGR recycle particles and fuel bonding matrices at accelerated flux levels under reference HTGR irradiation conditions of temperature, temperature gradient, and fast fluence exposure (> 0.18 MeV).

6609 (ORNL—5274) **Gas-cooled reactor programs. High-temperature gas-cooled reactor base-technology program progress report for July 1, 1975—December 31, 1976.** Homan, F.J.; Kasten, P.R. (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 426p. Dep. NTIS, PC A19/MF A01.

Progress is reported in the following areas: prestressed concrete pressure vessel development, structural materials, fission product technology, kernel migration and irradiated fuel chemistry, coolant chemistry (steam-graphite reactions), fuel qualification, and characterization and standardization of graphite.

6610 (ORNL/NUREG/TM—78) **ORTAP: a nuclear steam supply system simulation for the dynamic analysis of high temperature gas cooled reactor transients.** Cleveland, J.C.; Hedrick, R.A.; Ball, S.J.; Delene, J.G. (Oak Ridge National Lab., Tenn. (USA)). 10 Aug 1977. Contract W-7405-ENG-26. 94p. Dep. NTIS, PC A05/MF A01.

ORTAP was developed to predict the dynamic behavior of the high temperature gas cooled reactor (HTGR) Nuclear Steam Supply System for normal operational transients and postulated accident conditions. It was developed for the Nuclear Regulatory Commission (NRC) as an independent means of obtaining conservative predictions of the transient response of HTGRs over a wide range of conditions. The approach has been to build sufficient detail into the component models so that the coupling between the primary and secondary systems can be accurately represented and so that transients which cover a wide range of conditions can be simulated. System components which are modeled in ORTAP include the reactor core, a typical reheater and steam generator module, a typical helium circulator and circulator turbine and the turbine generator plant. The major plant control systems are also modeled. Normal operational transients which can be analyzed with ORTAP include reactor start-up and shutdown, normal and rapid load changes. Upset transients which can be analyzed with ORTAP include reactor trip, turbine trip and sudden reduction in feedwater flow. ORTAP has also been used to predict plant response to emergency or faulted conditions such as primary system depressurization, loss of primary coolant flow and uncontrolled removal of control poison from the reactor core.

6611 (ORNL/TM—5743) **Effect of deposition conditions on the properties of pyrolytic silicon carbide coatings for high-temperature gas-cooled reactor fuel particles.** Stinton, D.P.; Lackey, W.J. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 30p. Dep. NTIS, PC A03/MF A01.

Silicon carbide coatings on HTGR microsphere fuel act as the barrier to contain metallic fission products. Silicon carbide coatings were applied by the decomposition of CH_3SiCl_3 in a 13-cm-diam (5-in.) fluidized-bed coating furnace. The effects of temperature, CH_3SiCl_3 supply rate and the H_2:CH_3SiCl_3 ratio on coating properties were studied. Deposition temperature was found to control coating density, whole particle crushing strength, coating efficiency, and microstructure. Coating density and microstructure were also partially determined by the H_2:CH_3SiCl_3 ratio. From this work, it appears that the rate at which high quality SiC can be deposited can be increased from 0.2 to 0.5 μm/min.

6612 **Present state and development potential of high temperature reactors.** Hardt, L. *Glueckauf;* **113**: No. 11, 545-551(2 Jun 1977). (In German).

General review of nuclear reactors is followed by evaluation of boiling water, pressurized water, and fast breeder reactors. Characteristics and safety aspects of high temperature reactors are discussed and use of process heat derived from them for coal gasification is considered. Development of reactor with helium turbine is noted. 9 refs.

6613 **Schmehausen power station site and its structures.** Krolewski, H. (Ver Elektrizitaetswerke, Westfael, Dortmund, Ger.). *VGB Kraftwerkstech.;* **57**: No. 4, 259-269(Apr 1977). (In German).

At Hamm-Schmehausen three fossil fuel fired units are in operation at present. The thorium high temperature reactor of 300 MW electrical capacity is under construction alongside. The licensing procedure for a further nuclear unit (1300 MW pressurized water reactor) is progressing and the plant supply contract has been placed. Particular note is made of certain interesting features in the plant structural engineering, such as the prestressed concrete pressure vessel of the thorium high temperature reactor, dry cooling with the cooling tower shell in the form of a cable net, and the supplying of make-up water to the cooling tower by artificial means. 20 refs.

6614 **Several results from an experimental checking of the protection of the RBM-K-1000 reactor.** Badyaev, V.V.; Glushchenko, A.I.; Egorov, Yu.A.; Pavlov, S.D.; Pankrat'ev, Yu.V.; Khandamirov, Yu.E.; Shcherbina, V.G. *Radiats. Bezop. Zashch. AES;* No. 1, 182-191(1975). (In Russian).

The authors discuss the results of experimental investigations of the radiation situation on the first block of the Leningrad Atomic Electric Power Plant during the period of physical and energy startups and yield of the plant for nominal power for the purpose of determining the effectiveness of biological protection, checking the correctness of the project computations and quality of assembly of the protection.

POWER REACTORS, NON-BREEDING, OTHERWISE MODERATED OR UNMODERATED

6615 (LA—6900-MS) **Gas core reactor power plants designed for low proliferation potential.** Lowry, L.L. (comp.). (Los Alamos

Scientific Lab., N.Mex. (USA)). Sep 1977. Contract W-7405-ENG-36. 41p. Dep. NTIS, PC A03/MF A01.

The feasibility of gas core nuclear power plants to provide adequate power while maintaining a low inventory and low divertability of fissile material is studied. Four concepts were examined. Two used a mixture of UF_6 and helium in the reactor cavities, and two used a uranium-argon plasma, held away from the walls by vortex buffer confinement. Power levels varied from 200 to 2500 MWth. Power plant subsystems were sized to determine their fissile material inventories. All reactors ran, with a breeding ratio of unity, on ^{233}U born from thorium. Fission product removal was continuous. Newly born ^{233}U was removed continuously from the breeding blanket and returned to the reactor cavities. The 2500-MWth power plant contained a total of 191 kg of ^{233}U. Less than 4 kg could be diverted before the reactor shut down. The plasma reactor power plants had smaller inventories. In general, inventories were about a factor of 10 less than those in current U.S. power reactors.

6616 Ultrasonic inspection of end cap welds in thin walled fuel elements. van den Andel, J. (Westinghouse Can Ltd, Hamilton, Ont). *Mater. Eval.;* **35**: No. 2, 56-60(Feb 1977).

The quality of end cap welds in thin walled (0.4 mm) fuel elements can be determined by using high frequency (>10 MHz), sharp focused (<0.4 mm phi), long focus (25 mm) transducers. It was necessary to determine the true angle of refraction, which was different from what theory predicted, and the attenuation of a focused beam skipping inside a thin wall. It was found possible to penetrate the weld zone, recognize the weld contours and determine the presence of defects smaller than 0.1 mm deep. Case histories show that no weld considered good by ultrasonics was defective and nearly all defects found ultrasonically were also found metallographically.

6617 Conservation with CANDU. Hare, M.G.; Ross-Ross, P.A. (AECL, Chalk River, Ont). *Eng. J. [Montreal];* **60**: No. 1, 9-13(Jan-Feb 1977).

The CANDU reactor has demonstrated that Canada has a reliable and economic alternative energy source that saves scarce fossil fuels. Advances in CANDU nuclear technology can be made in an evolutionary manner that will ensure sufficient nuclear resources for centuries. During the past decade, nuclear power has come into the picture. Some utilities are planning on nuclear power to be the mainstay of their additional electrical energy supply until well beyond the year 2000. In Canada, the forecasts of nuclear electric growth are for over 70,000 Mw(e) by the year 2000. Predictions throughout the rest of the world tend to follow a similar pattern. For the next few decades, much of the world's nuclear power will come from thermal reactors of which the CANDU reactor is one of the common types.

6618 Radioactive decay properties of CANDU fuel--volume 1: the natural uranium fuel cycle. Clegg, L.J.; Coady, J.R. Chalk River, Ont.; Atomic Energy of Canada, Ltd. (Jan 1977). vp.

The computer code CANIGEN was used to obtain the mass, activity, decay heat and toxicity of CANDU fuel and its component isotopes. Data are also presented on gamma spectra and neutron emissions. These data are reserved for unirradiated fuel, uranium ore, and uranium mill tailings, and are computed for fuel irradiated to levels of burnup ranging from 140 GJ/kg U to 1150 GJ/kg U. Finally, the data are given which relate to the plutonium product and the high level wastes produced during fuel reprocessing. 18 refs.

POWER REACTORS, BREEDING

REFER ALSO TO CITATION(S) 6023, 6048, 6673, 6696, 6713, 6714, 6716, 6721, 6722, 6723, 6725, 6726, 6727, 6728, 6729, 6730, 6731, 6732, 6733, 6735, 6736, 6737, 6738, 6739, 6740, 6741, 6742, 6743, 6744, 6745, 6746, 6747, 6749, 6751, 6752, 6753, 6754, 6755, 6757, 6758, 6759, 6760, 6761, 6762, 6763, 6764, 6765, 6766, 6767, 6768, 6769, 6770, 6771, 6772, 6773, 6774, 6775, 6776, 6777, 6779, 6781, 6782, 6783, 6784, 6785, 6790, 6791, 6793, 6794, 6795, 6802, 6803, 6804, 6805, 6899

6619 (AI-ERDA—13198) **Fast reactor fluence dosimetry. Technical progress report, December 1976—May 1977.** (Atomics International Div., Canoga Park, Calif. (USA)). 31 Aug 1977. Contract EY-76-C-03-0824-002. 26p. .

Progress is summarized in studies and tests related to the development and demonstration of ^{10}B and ^{6}Li helium accumulation fluence monitors as a reliable and accurate method of measuring LMFBR neutron fluence. (DG)

6620 (AI-ERDA—13204) **Sodium technology and cover gas seal development programs. Quarterly technical progress report, April—June 1977.** (Atomics International Div., Canoga Park, Calif. (USA)). 29 Jul 1977. Contract EY-76-C-03-0824-001. 53p. .

Progress is summarized in LMFBR-FFTF seals testing, cover gas seal components development, and sodium removal and component decontamination techniques. (DG)

6621 (AI-ERDA—13206) **High-temperature piping design technology. Quarterly technical progress report, April—June 1977.** Jetter, R.I.; Naugle, F.V. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Aug 1977. Contract EY-76-C-03-0824-021. 23p. Dep. NTIS, PC A02/MF A01.

Progress is summarized in the following LMFBR piping design studies: long-range program planning, collection of piping failure and construction defect data, analysis of systems with prior successful operating history, and compilation of fatigue data for 2-¼ Cr-1 Mo and type 316 stainless steels. (DG)

6622 (ANL-AFP—22) **Apparatus to simulate nuclear heating in advanced fuels.** Wrona, B.J.; Galvin, T.M.; Johanson, E. (Argonne National Lab., Ill. (USA)). Oct 1976. Contract W-31-109-ENG-38. 20p. Dep. NTIS, PC A02/MF A01.

A direct-electrical-heating apparatus has been built to simulate in-reactor temperature gradients and heating conditions in both the mixed nitrides and carbides of uranium and plutonium. The apparatus has the capability for the investigation and direct observation of fuel-behavior phenomena that should significantly enlarge the data base on mixed carbides and nitrides at temperatures near and above their melting points. In addition to heating UC, results of prooftests showed that the apparatus has the capability to heat graphite, 30 vol % ZrC in graphite, B_4C control-rod pellets, and stainless steel.

6623 (ANL-AFP—28) **Advanced fuels program. Quarterly progress report, January—March 1976.** Kittel, J.H. (comp.). (Argonne National Lab., Ill. (USA)). 1976. Contract W-31-109-ENG-38. 271p.

Progress in studies on advanced LMFBR fuels is reported in the following areas: steady-state irradiation tests, off-normal irradiation tests, performance modeling, design studies for FTR and CRBR, design studies for large plants, fuel properties, fuel chemical stability, environmental assessments, and safety.

6624 (ANL-AFP—32) **Sensitivity of power peaking analysis to large reactor core modeling.** King, M.J. (Argonne National Lab., Ill. (USA)). Oct 1976. Contract W-31-109-ENG-38. 47p. Dep. NTIS, PC A03/MF A01.

Various models of large LMFBRs, based on cylindrical and hexagonal geometries, are examined in regard to application to nuclear power peaking analysis. It is shown that the general behavior of power distributions during burnup in these large reactors implies that power shaping by control rod movement is desirable for minimizing the peaking factor. Due to current limitations of available three-dimensional computer codes, one- and two-dimensional models were used to test general assumptions of power shaping. However, it is demonstrated that these models are not appropriate for more accurate power peaking analysis. Comparison of results for nuclear power peaking factors in cylindrical and hexagonal geometries shows that the use of annular rings of control poison in the cylindrical models does not provide a realistic representation of banks of control rod assemblies.

6625 (ANL-AFP—33) **Advanced fuels program. Quarterly progress report, July—September 1976.** Kittel, J.H. (comp.). (Argonne National Lab., Ill. (USA)). 1976. Contract W-31-109-ENG-38. 199p.

Progress in studies on advanced LMFBR fuels is reported in the following areas: steady-state irradiation tests, off-normal irradiation tests, performance modeling, design studies for FTR and CRBR, design studies for large plants, fuel properties, fuel chemical stability, environmental assessments, and safety.

6626 (BNWL—2216) **Investigation of combined free and forced convection in a 2 x 6 rod bundle.** Quigley, M.S.; McMonagle, C.A.; Bates, J.M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1977. Contract EY-76-C-06-1830. 116p. Dep. NTIS, PC A06/MF A01.

The report documents a study designed to provide velocity and temperature data in a rod bundle geometry with low Reynolds number flows and severe radial power gradients. The data were then used to verify predictions by the COBRA computer program in the combined free and forced convection flow regime. Comparable flow conditions may occur in the radial blanket of a Liquid Metal Fast Breeder Reactor (LMFBR), in which radial power gradients up to 4 : 1 may exist across an assembly. Under low flow rate conditions the power gradient may cause significant buoyancy forces potentially resulting in flow redistribution within the radial assemblies. Consequently, there is a need to evaluate whether available thermal-hydraulic design codes can accurately predict the corresponding temperature and velocity profiles.

6627 (CONF-761001—P3, pp 1037-1046) **Behavior of carbide fuel in local and whole core accidents.** Siegmann, E.R.; Bergeron,

R.J.; Nickerson, G.M. (Combustion Engineering, Inc., Windsor, CT). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

This paper evaluated the likelihood of carbide fuel pin failure propagation and describes the behavior of carbide fuel during whole core accident sequences, such as transient overpower (TOP) and transient undercooling (TUC). Applicable methodology is used to assess the possibility that postulated local accidents will result in the propagation of pin failure across a carbide subassembly. Of the three propagation mechanisms considered, local blockages, fuel coolant interaction (FCI), and fission gas release, only FCI is judged to have more than a remote possibility of causing propagation. Comparison is made between oxide and carbide fuel pins during both TOP and TUC. Results indicate that the sequence of events can vary with fuel type. Sodium bonding is found to influence the onset of cladding motion.

6628 (CONF-761001—P4, pp 1587-1595) **Model for predicting temperature fluctuation characteristics beyond the exit of LMFBR subassemblies with faults.** Eifler, I.W.; Nijsing, I.R. (Commission of the European Communities, Ispra, Italy). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

A model based on the theory of turbulent diffusion and including the effect of the coolant conductivity is described, which relates the main characteristics of the fluctuating temperature field in the plenum to those of the time average temperature profile at the bundle outlet, which is distorted as a consequence of a flow blockage. With the aim to show the potential of an early failure detection method based on temperature fluctuation measurements in the coolant plenum, the model has been applied to a number of practical situations. The applications concern the signal optimisation, "background" temperature fluctuations and signals caused by typical cooling anomalies.

6629 (CONF-770807—37) **Structural dynamics in LMFBR containment analysis: a brief survey of computational methods and codes.** Chang, Y.W.; Gvildys, J. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 19p. Dep. NTIS, PC A02/MF A01.

From 4. international conference on structural mechanics in reactor technology; San Francisco, California, United States of America (USA) (15 Aug 1977).

In recent years, the use of computer codes to study the response of primary containment of large, liquid-metal fast breeder reactors (LMFBR) under postulated accident conditions has been adopted by most fast reactor projects. Since the first introduction of REXCO-H containment code in 1969, a number of containment codes have evolved and been reported in the literature. The paper briefly summarizes the various numerical methods commonly used in containment analysis in computer programs. They are compared on the basis of truncation errors resulting in the numerical approximation, the method of integration, the resolution of the computed results, and the ease of programming in computer codes. The aim of the paper is to provide enough information to an analyst so that he can suitably define his choice of method, and hence his choice of programs.

6630 (CONF-770807—41) **Development of a finite-strain fuel-element model.** Jankus, V.Z.; Shack, W.J. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 11p. Dep. NTIS, PC A02/MF A01.

From 4. international conference on structural mechanics in reactor technology; San Francisco, California, United States of America (USA) (15 Aug 1977).

The LIFE-III computer code was developed to calculate the thermal and mechanical response of mixed-oxide fuel elements in a fast-reactor environment. It incorporates a one-dimensional, steady-state heat-transfer analysis and a structural analysis based on generalized plane strain. Temperature, stress, and strain can be calculated for any specified history of reactor power cycling. Up to seven axial segments are permitted to account for axial variations in power and coolant temperature. Fuel restructuring, migration of fabricated porosity, fuel and cladding swelling and creep, fission-gas release, and fuel cracking, crack healing, and hot pressing are included in the analysis. The mechanical analysis in the original version of the code was based on the assumption that the strains in the fuel and cladding could be considered infinitesimal. However, this assumption is grossly violated in the vicinity of the central void of the fuel, since the opening and closing of the void involves displacements of the order of the void radius. To provide a more accurate description of the mechanical behavior of the fuel element, a finite-strain fuel-element model has been developed. The finite-strain calculations in the modified code are based on an incremental analysis. The deformation history of the fuel element is analyzed in discrete time steps, and the basic geometry of the element is updated after each time step. To perform the calculation for nonlinear materials, each axial segment is divided into a number (less than or equal to 20) of concentric cylindrical shells. The analysis maintains the overall force equilibrium of each ring and enforces geometric compatibility between the shells, and the boundary pressures and displacement increments at the inner and outer surfaces of a shell are related to the stresses and the strain increments within the shell in a novel manner.

6631 (CONF-770822—5) **Operating limits for subassembly deformation in EBR-II.** Bottcher, J.H. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 10p. Dep. NTIS, PC A02/MF A01.

From American Nuclear Society meeting; Chattanooga, Tennessee, USA (8 Aug 1977).

The deformation of a subassembly in response to the core environment is frequently the life limiting factor for that component in an LMFBR. Deformation can occur as diametral and axial growth or bowing of the subassembly. Such deformation has caused several handling problems in both the core and the storage basket of EBR-II and may also have contributed to reactivity anomalies during reactor operation. These problems generally affect plant availability but the reactivity anomalies could lead to a potential safety hazard. Because of these effects the deformation mechanisms must be understood and modeled. Diametral and axial growth of subassembly ducts in EBR-II is due to swelling and creep and is a function of temperature, neutron fluence and stress. The source of stress in a duct is the hydraulic pressure difference across the wall. By coupling the calculated subassembly growth rate to the available clearance in the core or storage basket a limiting neutron fluence, or exposure, can be established.

6632 (CONF-770933—1) **CRBRP flow induced vibration program.** Novendstern, E.H.; Grochowski, F.A.; Yang, T.M.; Ryan, J.A.; Mulcahy, T.M. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.; General Electric Co., Sunnyvale, Calif. (USA). Energy Systems and Technology Div.; Hanford Engineering Development Lab., Richland, Wash. (USA); Argonne National Lab., Ill. (USA)). 1977. Contract EY-76-C-15-2395. 57p. Dep. NTIS, PC A04/MF A01.

From International Atomic Energy Agency, international working group on fast reactors; Argonne, Illinois, USA (20 Sep 1977).

The program to assure the structural adequacy of CRBRP components during its planned 30 years of operation is described. The program includes (1) an assessment of reactor components relative to their susceptibility to FIV, (2) designing to minimize component excitation due to FIV, (3) scale model tests to measure structural response during simulated operating conditions and (4) preoperational tests. An overview of the CRBRP test program is described. Additionally, details of scale model testing of reactor internals and the steam generator is described in more detail.

6633 (COO—2245-44TR) **Coolant mixing in the LMFBR outlet plenum.** Chen, Y.B.; Golay, M.W. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Jun 1977. Contract EY-76-S-02-2245. 224p. Dep. NTIS, PC A10/MF A01.

Small scale experiments involving water flows are used to provide mean flow and turbulence field data for LMFBR outlet plenum flows. Measurements are performed at Reynolds Number (Re) values of 33000 and 70000 in a 1/15-scale FFTF geometry and at Re = 35000 in a 3/80-scale CRBR geometry. The experimental behavior is predicted using two different turbulence model computer programs, TEACH-T and VARR-II. It is found that the qualitative nature of the flow field within the plenum depends strongly upon the distribution of the mean inlet velocity field, upon the degree of inlet turbulence, and upon the turbulence momentum exchange model used in the calculations. It is found in the FFTF geometry that the TEACH-T predictions are better than that of VARR-II, and in the CRBR geometry neither code provides a good prediction of the observed behavior. From the sensitivity analysis, it is found that the production and dissipation of turbulence are the dominant terms in the transport equations for turbulent kinetic energy and turbulent energy dissipation rate, and the diffusion terms are relatively small. From the same study a new set of empirical constants for the turbulence model is evolved for the prediction of plenum flows.

6634 (COO—2426-101) **System design of carbide fuel. Quarterly progress report, April—June 1977.** Noyes, R.C. (Combustion Engineering, Inc., Windsor, Conn. (USA)). 1977. Contract EY-76-C-02-2426. 76p. (CE-FBR—77-339). .

The expected costs and benefits of introducing carbide fueled assemblies into Liquid Metal Fast Breeder Reactors are studied. Associated with this overall objective are the parallel objectives of identifying the important characteristics of optimum commercial carbide fueled LMFBR designs and the comparison of such designs with designs of oxide fueled LMFBR's. Determination of efficient and acceptable means of testing carbide and other advanced fuels in FTR and CRBR, including detailed design and analysis of experimental FTR driver fuel assemblies, is a major objective of this work.

6635 (COO—4116-2) **Investigation of accuracy and computation time of a hierarchy of growth rate definitions.** Maudlin, P.J.; Borg, R.C.; Ott, K.O. (Purdue Univ., Lafayette, Ind. (USA). School of Nuclear Engineering). Jul 1977. Contract EY-76-S-02-4116. 21p. Dep. NTIS, PC A02/MF A01.

A numerical illustration of the hierarchy of four logically different procedures for the calculation of the asymptotic growth of fast breeder fuel is presented. Each hierarchy level is analyzed in terms of accuracy and computational effort. Using the first procedure as reference, the fourth procedure, which incorporates the isotopic breeding worths, w vector*, requires a minimum amount of effort with a negligible decrease in accuracy.

6636 (COO—4116-3) **Investigation of the growth rate for joint fast breeder reactor and light water reactor operation.** Hanan, N.A.; Borg, C.R.; Ott, K.O. (Purdue Univ., Lafayette, Ind. (USA). School of Nuclear Engineering). Jul 1977. Contract EY-76-S-02-4116. 24p. Dep. NTIS, PC A02/MF A01.

An investigation of fuel consumption and breeding characteristics of FBR-LWR joint operation is presented. The FBR operates in a closed cycle with joint-reprocessing of core and blanket material. The LWR-portion that runs on FBR plutonium operates in an open cycle. The growth rate of the system is defined based upon the fact that the discharge from the system will make up a fraction of an identical system; the system growth rate is found to have an almost linear dependence on the fraction of the LWR fed by plutonium from the FBR. The LWR growth rate, which is negative, is a constant and represents the fraction of the fuel burnt in the LWR-fraction that runs on FBR plutonium per year.

6637 (COO/4116—1) **Impact of delays in plutonium use on the stationary growth rate of fast breeder reactor fuel.** Borg, R.C.; Ott, K.O. (Purdue Univ., Lafayette, Ind. (USA). School of Nuclear Engineering). Jul 1977. Contract EY-76-S-02-4116. 55p. Dep. NTIS, PC A04/MF A01.

The hierarchy of the four growth rate expressions originally derived from an instantaneous reuse scheme is expanded to account for finite burnup in the core and blanket, β-decay of ^{241}Pu, core and blanket loading schemes, reuse delays due to reprocessing and fabricating fuel and external fuel cycle losses. The most general growth rate expression, obtained from the asymptotic slope of the accumulating fuel material in an expanding park of breeder reactors, is formally the same in both cases. Formulation of the growth rate based on the condensation of the detailed information of the equilibrium fuel cycle for a single reactor, is more complicated than without delays due to the composition difference between the average residing and excess discharge material. The third growth rate expression results from a slightly more complicated fuel-cycle eigenvalue problem than without delays. The last definition employs isotopic breeding worth factors obtained from the adjoint fuel cycle eigenvalue problem.

6638 (CRBRP-PMC—77-04) **Clinch River Breeder Reactor Plant. Technical review, Fall 1977.** (Clinch River Breeder Reactor Plant Project Office, Oak Ridge, Tenn. (USA)). 1 Oct 1977. Contract EY-76-C-15-1200. 47p. .

Included are sections dealing with seismic design of cantilever cylindrical shells, uniaxial compressive strengths of concrete for temperatures reaching 1033K, and practical aspects of probabilistic structural reliability analyses. (DG)

6639 (GA-A—14098) **Structural analysis of the gas-cooled fast breeder reactor core support.** Chang, K.H.; Chuang, A.S.; Washington, C.E. (Gulf General Atomic Co., San Diego, Calif. (USA)). Jun 1977. Contract EY-76-C-03-0167-023. 139p. Dep. NTIS, PC A07/MF A01.

The report presents the results of a comprehenaive study of the effect of pressure loading on the gas-cooled fast breeder reactor (GCFR) core support structure. Two theories are investigated for the core support grid plate: thin plate theory and anisotropic elasticity theory. The case of an isotropic thick plate is also presented. The effect of transverse shear and normal stress in a thick plate and the effect of the outer solid rim of the perforated interior portion of the grid plate are studied. The grid plate support structure upper flange, support cylinder, and lower flange are analyzed, and the structural interaction between the grid plate and the support structure is discussed. Numerical results are presented for each analyss. The stresses obtained in the grid plate and the support structure are evaluated according to the requirements of the ASME Boiler and Pressure Vessel Code, Section III, Division 1, and the deflections of the grid plate are examined to determine whether the reactivity insertion limitation on the plant safety requirements is met. Since the final dimensions of the core support structure are not certain at this time, the report is not considered to be a final design stress report; however, it does examine the feasibility of the design and also demonstrates the analytical methods used to solve the grid plate problem from the standpoint of pressure loading.

6640 (GEFR—10028-62) **Core engineering sixty-second quarterly report, February—April 1977.** (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). May 1977. Contract EY-76-C-03-0893-011. 52p. .

Progress is summarized in the areas of LMFBR fuel assembly engineering and core component design analysis. (DG)

6641 (HEDL-TME—76-28) **Sodium engineering and technology technical progress report, October, November, December 1976.** Atwood, J.M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1977. Contract EY-76-C-14-2170. 112p. .

Progress in LMFBR-related sodium technology studies is reported in the areas of radioactivity control technology, sodium systems technology, and hydraulics and mechanics studies.

6642 (ICP—1050-11) **Fast reactor fission yields for ^{239}Pu and ^{241}Pu.** Maeck, W.J. (Idaho National Engineering Lab., Idaho Falls (USA)). Aug 1977. Contract EY-76-C-07-1540. 58p. Dep. NTIS, PC A03/MF A01.

Fast fission yield data are presented for ^{239}Pu and ^{241}Pu irradiated in EBR-II. The measurement technique was isotope dilution mass spectrometry. The neutron environment for the irradiation is defined, and chemical separation and mass spectrometric procedures are briefly described. Recommendations and suggestions for the selection of burnup monitors are given.

6643 (IWGFR—5) **International working group on fast reactors.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Fast Reactors). 1975. 193p. (CONF-750527—(Summ.)). Dep. NTIS (US Sales Only), PC A09/MF A01.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

Separate abstracts were prepared for 18 of the 23 papers included. Abstracts have appeared previously for the remaining 5 papers.

6644 (IWGFR—5, pp 18-24) **Fuel clad failures in Rapsodie reactor and an experimental irradiation program in order to obtain voluntary and spontaneous failures.** Chalony, A.; Chantoin, P. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

An experimental program at the RAPSODIE Reactor for the study of FBR fuel pin failure is described. The results to date are also presented.

6645 (IWGFR—5, pp 30-34) **Study of fuel failure due to manufacturing faults.** Gatesope, J.P.; Perret, F. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The mechanism for FBR fuel pin failure following sodium entry into the pin through a defective weld is discussed.

6646 (IWGFR—5, pp 35-37) **Contribution to the specialists meeting on fuel failure mechanisms.** Goetzmann, O. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The mechanism for inner cladding attack in FBR fuel pins is discussed.

6647 (IWGFR—5, pp 43-49) **Complementary information to summary report on fuel failures, theoretical approach, and special programs.** Mayer, H. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The objective of this note is to provide recent complementary information on the status of DFR-455 and Mol-7B and to cover some additional aspects of theoretical treatment of fuel failure mechanisms. Topics of an initiated safety related program are mentioned without detailed discussion.

6648 (IWGFR—5, pp 50-58) **Summary on fuel pin failures and theoretical approach.** Mayer, H. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

It is the purpose of this report to summarize the essential experimental facts and to give some hypothesis for interpretation as far as possible today. The status of theoretical description of fuel pin behaviour (code IAMBUS) is given with emphasis on a partial interpretation of failures. Both of course cannot be conclusive, but will show the main lines of thinking to be followed in the future. The findings and results reported are part of the joint fuel development program for the SNR-300 (Kernkraftwerk Kalkar).

6649 (IWGFR—5, pp 59-64) **Fuel failure studies and experiences in Italy.** Cicogani, G. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

Of great importance in the design of the fast breeder fuel element are the assumptions and the hypotheses on the statistical behaviour of the fuel pin under both nominal and transient conditions. It is well known that the assumed pin failure limits, as well as the behaviour of a defected pin under operation, affect the average conditions of the core. Therefore a better understanding of the pin failure and damage propagation related mechanisms is mandatory to improve the design criteria and specifications for the fuel and, finally, the economics of the system. A short review the activities carried out in this field by the Fast Reactor Department of the CNEN, both in-pile and out-of-pile, and of the effort on the calculation models and codes recently started by NIRA is presented.

6650 (IWGFR—5, pp 65-66) **DFR 332/5 fuel pin irradiation.** Kawata, T.; Kaneko, H.; Uematsu, K. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

PNC undertook four irradiation experiments in the Dounreay Fast Reactor of UK. One of them called DFR332/5 resulted in a failure of a fuel pin. Three fuel pins were assembled in a "trefoil" vehicle and irradiated in the DFR under a downward stream of reactor coolant NaK. Irradiation was undertaken for five runs with an intermediate non-destructive examination between the fourth and the fifth run. The intermediate NDT showed that all three pins were intact after consecutive four runs to 4.64% burn-up (max.). Then the pins were re-assembled in a new trefoil vehicle and returned to the reactor for one further run to 5.92% burn-up (max.). A post irradiation nondestructive examination and puncture test for F.P. gas analysis were carried out at Dounreay Hot Laboratory. One of the pins were found to be failed during the final run.

6651 (IWGFR—5, pp 69-82) **PNC irradiation programs.** Kawata, T.; Kikuchi, S.; Uematsu, K. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The Power Reactor and Nuclear Fuel Development Corporation has been conducting various irradiation experiments for fuels and materials in support of design and construction of "JOYO" experimental fast reactor and "MONJU" prototype fast reactor.

6652 (IWGFR—5, pp 83-84) **PIPER: a new fast reactor fuel pin performance code.** Kikuchi, S.; Yokouchi, Y. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

A new computer program (PIPER--Pin Performance) has been developed for analyzing and predicting LMFBR fuel pin performance with burnup. The objective of the PIPER program is to calculate the fuel pin performance including stresses and deformation in a reactor as the result of a history of power, coolant temperature, coolant flow and other operating conditions. The PIPER program treats the quasi-static transient analysis of a fuel element in the form of a long metallic tube which is the clad for a cylindrical column of porous fuel. Encapsulated pins can be treated as an option. The geometry is axisymmetric and all stresses, strains, forces and deflections are assumed to be axisymmetric. The fuel pin can be divided into as many as ten arbitrary axial sections plus one axial section to treat the fission gas plenum. The fuel region can be divided into up to twenty equal mass radial regions for all calculations except the stress and deformation calculations. To limit the computer running time required for the stress-strain calculations, the fuel region radial nodes are grouped into three regions for the stress-deformation calculations. Mechanical properties, temperature, porosity and concentration dependent models are appropriately weighted for each of these three regions.

6653 (IWGFR—5, pp 84-87) **U.K. studies on fuel failure mechanisms.** Matthews, J.R.; Teague, H.J. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

From the point of view of economic operation of fast reactors the subject of fuel failure has always been of central concern. Irradiation programmes, with associated techniques of experimental and theoretical analysis have long been established to develop data on fuel life and operating limits. In recent years there has been a growth of interest in fuel failure mechanisms in relation to safety studies. A different type of problem is thereby posed, in that the need to study extreme developments of initial failures introduces a wide range of physical conditions, often coinciding with wide departures from normal geometry. Moreover, these conditions are not among those normally encountered even in prototype reactor operation and the accumulation of data depends on a synthesis of results from many different experiments. None of these is representative in all the features desired, and it is necessary to depend heavily on a basic understanding of physical processes with the use of sophisticated analytical techniques to extrapolate to full-scale reactor conditions. The current position in the UK is summarized in relation to the overall need for understanding of fuel behaviour in both normal operation and accident conditions.

6654 (IWGFR—5, pp 152-157) **Experimental study of fast reactor fuel pin performance.** Davydov, E.F.; Kuzmin, V.I.; Lebedev, I.G.; Syuzev, V.N. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

Presented in this report are the results of extensive tests of fast fuel pin performance carried out in the BOR-60 reactor. Oxide fuel pins of the actual design were successfully irradiated to 10% burnup of heavy atoms. The 10 to 11% burnup fuel cladding mechanical strain was found to be not in excess of 0.5% and 1.3% for oxide and carbide fuel pins, respectively. The fuel pin characteristics are presented for those with failed cladding. The analysis of failures showed that they were caused mainly by cladding embrittlement resulted from chemical effects of impurities present in fuel. The failures were observed to occur under both steady-state and transient conditions. The further study program is presented aimed at the optimization of the oxide fuel element design and fabrication technology and testing several carbide fuel pin versions.

6655 (IWGFR—5, pp 158-174) **Basic principles of prognostication for oxide fuel element working ability of sodium cooled fast reactors.** Golovnin, I.S.; Likhatehov, J.I. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The basic parameter influencing the working ability of oxide fuel elements in sodium cooled fast reactors are determined, the principles for the choice of their optimal values are suggested and the main changes appearing in the oxide fuel element during its operation are discussed. The dynamic scale models of thermal-physical and strength estimation of fuel element design are given as well as the criteria for operational reliability. The data is given proceeding from the theoretical conceptions and experimental results on the behaviour of materials under in-off pile conditions.

6656 (ORNL—5178) **TSF measurements of neutron transmission through an AI-LMFBR lower axial shield mockup. 189a No. 10028, Activity No. HN 04 01 01 1.** Clifford, C.E.; Muckenthaler, F.J.; Stevens, P.N. (Oak Ridge National Lab., Tenn. (USA)). Aug 1977. Contract W-7405-ENG-26. 128p. .

The results are presented of an experiment performed at the ORNL Tower Shielding Facility to measure neutron transmission through a mockup of a blanket-shield assembly designed by Atomics International for the lower axial region of the Liquid Metal Fast Breeder Reactor demonstration plant. The neutron source for the experiment was a collimated beam from the Tower Shielding Reactor II modified to simulate the energy spectrum of a fast reactor. The mockup contained a UO_2 blanket region and a sodium-flow transition region, both of which were penetrated by a cylindrical plug simulating various conditions in a central control-rod channel, plus upper and lower grid plates separated by a sodium plenum region. Measurements were made of the fluence and energy spectra of neutrons both within and emerging from several different configurations comprised of sections of the mockup. The complete set of data obtained in the experiment are presented.

6657 (ORNL/Sub—4485/1) **Development and application of the PLANS computer program for analysis of nuclear reactor structural components.** Levy, A.; Pifko, A.; Armen, H. Jr. (Grumman Aerospace Corp., Bethpage, N.Y. (USA). Research Dept.). Jun 1977. Contract W-7405-ENG-26-4485. 65p. (RE—542). .

PLANS is a group of finite element computer programs for the nonlinear analysis of complex structures. Four modules of the PLANS group described in the report are BEND, for the elastic-plastic analysis of built-up structures where bending and membrane effects are significant; HEX, for the three-dimensional elastic-plastic analysis of general solids; REVBY, for the elastic-plastic analysis of axisymmetrically loaded bodies of revolution; and OUT-OF-PLANE-GM, for the elastic-plastic and geometric nonlinear analysis of built-up sheet-stringer type structures. The capabilities and present status of these modules are summarized. All of the modules in PLANS employ the "initial strain" concept within an incremental procedure to account for the effect of plasticity and include the capability for cyclic analysis. Geometric nonlinearities are included in OUT-OF-PLANE-GM using the "updated" or convected coordinate approach.

6658 (WARD-CN—3045-4) **Analytical comparison of the irradiation behavior of fast reactor carbide and oxide fuel pins.** Nayak, U.P.; Boltax, A.; Skalka, R.J.; Biancheria, A. (Westinghouse Electric

Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1977. Contract EY-76-C-02-3045-027. 38p. .

Advanced breeder reactor system design studies have shown that mixed U_1Pu carbide fuel provides significant advantages over U,Pu oxide fuel with respect to nuclear, fuel-cycle and safety aspects. This report gives a comparative evaluation of the irradiation behavior of the two fuel types under steady-state and transient conditions, based on the LIFE-III fuel performance code. The analytical results show that properly designed carbide fuel pins will perform as successfully as oxide fuel pins in achieving high burnups on a reliable basis. In addition, for slow and terminated rapid overpower transients, carbide fuels are expected to cause lower levels of FCMI than oxide fuel pins. However, experimental verification of this prediction is required.

6659 (WARD-CR—3045-17) **Core restraint development. Quarterly progress report for period ending May 31, 1977.** Thompson, D.C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Aug 1977. Contract EY-76-C-02-3045-M. 25p. .

Progress related to the development of LMFBR reactor core restraints is summarized in the following areas: three-dimensional development tests, test component friction tests, simulated fuel assemblies, facility modification for full core tests, and TRITON code development. (DG)

6660 (WARD-D—0178) **Closure head capability for third level structural margin loading.** Todd, M.A.; Prevenslik, T.V.; Elder, G.G. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jun 1977. Contract EY-76-C-15-1200. 195p. .

The results of the most recent and detailed analysis of response of the Clinch River Breeder Reactor Plant Closure Head System to Third Level Structural Margin Loading are presented and assessed for Closure Head structural adequacy. Results obtained from scale model experiments are summarized and correlated with analytical predictions. Analytical and experimental results both indicate that the Closure Head is capable of withstanding 661 MJ Third Level Structural Margin loads without structural failures.

6661 (WARD-HT—3045-27) **High temperature structural design technology: validation. Quarterly progress report for the period ending May 31, 1977.** Bishop, E.C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jul 1977. Contract EY-76-C-02-3045. 120p. .

Progress is summarized in the testing and analysis of types 304 and 316 stainless steel plates and tubular specimens for the purpose of documenting design criteria for FFTF and LMFBR core structural components. Included are data on core design methods, basic specimen testing, tubular specimen testing, structure testing, FFTF/IHX nozzle testing, structural analysis, and crack propagation testing. (DG)

6662 (WARD-OX—3045-20) **Oxide fuel element development. Quarterly progress report for period ending September 30, 1975.** Boltax, A.; Saling, J.H. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jan 1976. Contract EY-76-C-02-3045-M. 91p. .

Topics reported on include: coordination and evaluation of mixed-oxide irradiation tests; post-irradiation examination of fast reactor experiments; grid-type fuel assembly design; fabrication, development, and testing of LMFBR fuel assemblies; evaluation and analysis of fuel and cladding irradiation behavior; improvement of analytical methods and lifetime codes; and transient code development. (GHT)

6663 (WARD-RB—3045-19) **Radial blanket design and development. Quarterly progress report for period ending May 31, 1977.** Bishop, E.C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jul 1977. Contract EY-76-C-02-3045. 78p. .

Progress in LMFBR radial blanket studies is summarized in the following areas: heat transfer testing, irradiation testing, flow orificing tests, and rod bundle compaction tests. (DG)

6664 (JAPFNR—260) **Progress report on fast breeder reactor development in Japan, October—December 1976.** (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Mar 1977. Translation of PNC-N—251-77-09. 10p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Work performed under United States—Japanese Fast Reactor Exchange Program.

Included are brief sections dealing with Joyo construction, Monju design, fast reactor kinetics, reactor components, reactor instrumentation, sodium technology, fuel development, reactor safety, and steam generator development. (DG)

POWER REACTORS, AUXILIARY, MOBILE, PACKAGE, AND TRANSPORTABLE

REFER ALSO TO CITATION(S) 6221, 6748

REGULATION AND LICENSING

REFER ALSO TO CITATION(S) 6722, 6900

6665 (DOCKET-50277—1043) **Peach Bottom Atomic Power Station, Units 2 and 3. Annual operating report: January—December 1976.** (Philadelphia Electric Co., Pa. (USA)). 28 Feb 1977. vp. (DOCKET-50278—926).

Unit 2 experienced 11 forced outages, 5 power reductions, and one major refueling outage which lasted about 3 months during which time the feedwater spargers were replaced. Net electrical power generated was 5,569,633 MWH with the generator on line 5,998 hrs. Unit 3 experienced 17 forced outages, 11 power reductions and 2 major outages. The first refueling outage began 12/24/77. Net electrical power generated was 6,049,644 MWH with the unit on line 6,829 hrs. Information is presented concerning operations, personnel exposures, radioactive releases, maintenance, and irradiated fuel examination. (FS)

6666 (HEDL-TI—75002-5) **FSAR amendment 5, revisions to supplement 6.** (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1977. Contract EY-76-C-14-2170. 16p. .

Information on the FFTF Reactor is presented concerning the performance of structures under tornado and seismic stresses, securing of reactor internals, and reactor kinetics.

6667 (NTISUB/C/142—77/005) **Nuclear Regulatory Commission issuances.** (Nuclear Regulatory Commission, Washington, D.C. (USA)). May 1977. vp. NTIS $4.75.

Issuances received from the U.S. Nuclear Regulatory Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented.

6668 (NTISUB/C/142—006) **Nuclear Regulatory Commission issuances.** (Nuclear Regulatory Commission, Washington, D.C. (USA)). Jun 1977. 213p. NTIS $4.75.

Issuances received from the U.S. Nuclear Regulatory Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DG)

6669 (NTISUB/C/142—007) **Nuclear Regulatory Commission issuances.** (Nuclear Regulatory Commission, Washington, D.C. (USA)). Jul 1977. 202p. NTIS $4.75.

Issuances received from the U.S. Nuclear Regulatory Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DG)

6670 (NUREG—0090-8) **Report to Congress on abnormal occurrences, April—June 1977.** (Nuclear Regulatory Commission, Washington, D.C. (USA)). 15 Jul 1977. 17p. NTIS.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report, the ninth in the series, covers the period from April 1 to June 30, 1977. The NRC has determined that during this period: there were two abnormal occurrences at the 64 nuclear power plants licensed to operate, one involved a breach of a plant's physical security system and the other involved degraded fuel rods; there were no abnormal occurrences at fuel cycle facilities (other than nuclear power plants); and there were two abnormal occurrences at other licensee facilities, one involved improper radioactive source handling procedures and the other involved overexposure of two radiographers. Information updating previously reported abnormal occurrences is also included.

6671 (ORNL/TM—5844) **Heat transfer calculations for the High Flux Isotope Reactor (HFIR). Technical specifications: bases for safety limits and limiting safety system settings.** Sims, T.M.; Swanks, J.H. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 24p. Dep. NTIS, PC A02/MF A01.

Heat transfer analyses, in support of the preparation of the HFIR technical specifications, were made to establish the bases for the safety limits and limiting safety system settings applicable to the HFIR. The results of these analyses, along with the detailed bases, are presented.

6672 (TID—22796) **LOFT integral test system final safety analysis report. Revision 1.** (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1977. Contract EY-76-C-07-1570. 827p. Dep. NTIS, PC A99/MF A01.

Information on the LOFT Reactor is presented concerning support buildings and facilities; instrumentation and controls; electrical systems; auxiliary systems; secondary coolant system; and waste systems and radiation protection.

6673 (TID—27798) **Development of licensing requirements for LMFBRs: a reactor designer's view.** Bradbury, P.; Huang, H.C. (Westinghouse Electric Corp., Madison, Pa. (USA)). 1977. Contract EY-76-C-15-2395. 10p. Dep. NTIS, PC A02/MF A01.

The framework of rules and regulations for nuclear power plant licensing in the U.S. has been developed and established mainly through the experience in LWR licensing. Because of the important differences in technology and design between LMFBR and LWR plants, development of specific new requirements and criteria and appropriate modification of old ones must be undertaken such that the established licensing regulations can be equally and fairly implemented for commercial LMFBR licensing. The paper presents a broad overview of U.S. licensing rules and regulations and provides a review of licensing criteria, standards and ongoing development effort, with a focus on commercial LMFBR licensing needs. The review results are presented and discussed. In addition, the selection of design basis accidents and the treatment of events beyond Design Base are also reviewed and discussed.

ECONOMICS

REFER ALSO TO CITATION(S) 6896

6674 **Steel structures in conventional thermal power plants and in nuclear power plants.** Wehr, J. (Rhein-Westfael Elektrizitaetswerk, Essen, Ger.). *VGB Kraftwerkstech.;* **57**: No. 4, 269-283(Apr 1977). (In German).

It is noted that with an increase in unit generating capacity and size, the total tonnage of steel used in power plant construction increases more than proportionately. In spite of the increasing use of reinforced concrete in nuclear power plants, due to more stringent safety requirements, there still exists for steel an essential field of application in the area of the safety containment. Because of technical safety conditions which increase requirements for quality, precision of installation and testing of steel structures are therefore necessary. 4 refs.

6675 **Nuclear energy and economic development.** Rao, V. (Univ of Mo, Rolla). *Energy Commun.;* **3**: No. 4, 377-406(1977).

The decision to choose an alternate energy base for future economic development is a very crucial one. The spread of fossil fuels being very lopsided, nuclear fission seems to be the alternative that commends itself as the optimal choice for a long time to come. When they become feasible, fusion and solar energy may, perhaps, rule in the ultimate steady growth state. 19 refs.

6676 (ERDA-tr—304) **Role of the nuclear power system in the fuel-power complex of the USSR.** Dollezhal, N.A.; Melent'yev, L.A. 1976. Translation of USSR report. 20p. Dep. NTIS, PC A02/MF A01.

Economic aspects of the use of nuclear power in the USSR are analyzed. Comparison with other energy sources is made.

CONSTRUCTION AND OPERATION

REFER ALSO TO CITATION(S) 7053

FUEL CYCLE

REFER ALSO TO CITATION(S) 6049

6677 (ORNL/NUREG/TM—131) **Solar energy as an alternate energy source to mixed oxide fuels in light-water cooled reactors.** Bertini, H.W. (Oak Ridge National Lab., Tenn. (USA)). 30 Jun 1977. Contract W-7405-ENG-26. 44p. Dep. NTIS, PC A03/MF A01.

Supplemental information pertaining to the generic environmental impact statement on the Pu recycling process for mixed oxide light-water cooled reactors (GESMO) was requested from several sources. In particular, the role of alternate sources of energy was to be explored and the implications of these alternate sources to the question of Pu recycle in LWRs were to be investigated. In this vein, solar energy as an alternate source is the main subject of this report, along with other information related to solar energy. The general conclusion is that solar energy should have little effect on the decisions concerning GESMO.

PROCESS HEAT REACTORS

REFER ALSO TO CITATION(S) 6095

NUCLEAR REACTOR TECHNOLOGY

THEORY AND CALCULATION

6678 (LA—6950-MS) **12G: code for conversion of isotope-ordered cross-section libraries into group-ordered cross-section libraries.** Resnik, W.M. II; Bosler, G.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1977. Contract W-7405-ENG-36. 30p. Dep. NTIS, PC A03/MF A01.

Many current reactor physics codes accept cross-section libraries in an isotope-ordered form, convert them with internal preprocessing routines to a group-ordered form, and then perform calculations using these group-ordered data. Occasionally, because of storage and time limitations, the preprocessing routines in these codes cannot convert very large multigroup isotope-ordered libraries. For this reason, the I2G code, i.e., ISOTXS to GRUPXS, was written to convert externally isotope-ordered cross section libraries in the standard file format called ISOTXS to group-ordered libraries in the standard format called GRUPXS. This code uses standardized multilevel data management routines which establish a strategy for the efficient conversion of large libraries. The I2G code is exportable contingent on access to, and an intimate familiarization with, the multilevel routines. These routines are machine dependent, and therefore must be provided by the importing facility. 6 figures, 3 tables.

6679 **Bubble chains in large diameter gas fluidized beds.** Werther, J. (Univ of Erlangen-Nuernberg, Erlangen, Ger). *Int. J. Multiphase Flow;* **3**: No. 4, 367-381(Jun 1977).

Using statistically based measuring methods for the determination of local bubble size distributions and local average bubble shapes in gas fluidized beds, bubble characteristics have been measured in a fluidized bed column. The results present experimental evidence that bubbles within large diameter fluidized beds do not rise completely randomly distributed in space but rather in the form of bubble chains which is in agreement with industrial operating experience in large scale fluid bed systems. Since the formation of bubble chains considerably reduces the residence time of the bubble gas this finding is of significance for the performance of fluidized bed reactors. The influence of the operating parameters on the extent of the bubble chain formation has been investigated and possible consequences of these results are discussed. 24 refs.

6680 **Oscillations in a third order differential equation modeling a nuclear reactor.** Troy, W.C. (Univ of Pittsburgh, Pa). *SIAM J. Appl. Math.;* **32**: No. 1, 146-153(Jan 1977).

A third order autonomous nonlinear ordinary differential equation which models a two temperature feedback nuclear reactor is considered. Using geometric methods and the Brouwer fixed point theorem, the existence of periodic solutions is shown over a specific range of parameters. In light of these results, conjectures are given discussing the global behavior of families of periodic solutions bifurcating from the steady state. 6 refs.

6681 **Positive solutions and criticality of the linear and some nonlinear neutron transport problems.** Pao, C.V. (NC State Univ, Raleigh). *SIAM J. Appl. Math.;* **32**: No. 1, 164-176(Jan 1977).

The existence and nonexistence of a nonnegative solution for linear and some nonlinear time-independent neutron transport problems in a multiplying transport medium are studied. This approach to the problem involves the construction of a "maximal" and a "minimal" sequence, each of which converges to a nonnegative solution of the problem. It is shown that these sequences converge monotonically to a maximal and minimal solution, respectively, if and only if there exists an upper solution. Through the construction of an upper solution, a simple criterion is obtained for insuring the criticality or subcriticality of the system when fission dominates absorption. This criterion leads to some explicit estimates on the critical size of the transport region in terms of the physical parameters of the transport medium. In particular, a simple relation for estimating the critical length of the slab problem is also given. 10 refs.

6682 **Asymptotic behavior of the solution of the integral transport equation in slab geometry.** Kaper, H.G.; Kellogg, R.B. (Argonne Natl Lab, Ill). *SIAM J. Appl. Math.;* **32**: No. 1, 191-200(Jan 1977).

The continuity and differentiability properties of the solution phi of a linear integral equation arising in transport theory is studied. This equation arises, for example, in the study of neutron transport in a nuclear reactor and in the study of photon scattering in stellar atmospheres. The equation is described by an operator T which maps bounded functions into Holder continuous functions. T does not commute with the differential operator D. In particular, the difference DT-TD introduces singularities near the boundary of the domain. A method is developed to generate a representation for any derivative D$sup m$ phi of phi, from which a representation is obtained for phi which explicitly demonstrates its asymptotic behavior near the boundary. 9 refs.

COMPONENTS AND ACCESSORIES

REFER ALSO TO CITATION(S) 7048

6683 (EUR—5667-e/f(Pt.1)) **Proceedings of the first ASTM-EURATOM symposium on reactor dosimetry. Part I.** (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1977. 847p. (In several languages). (CONF-750935—P1). of the European Communities, Luxembourg.

From 1. ASTM-Euratom symposium on reactor dosimetry(developments and standarization; Petten, Netherlands (22 Sep 1975).

Forty-six papers are presented concerning reactor dosimetry needs, required accuracies, and implications; spectrometry, activation, and unfolding; reaction rate measurements; and dosimetry applications. Fourteen papers have been previously abstracted and indexed.

6684 (EUR—5667-e/f(Pt.2)) **Proceedings of the first ASTM-EURATOM symposium on reactor dosimetry. Part II.** (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1977. 683p. (In French and English). (CONF-750935—P2). of the European Communities, Luxembourg.

From 1. ASTM-Euratom symposium on reactor dosimetry(developments and standarization; Petten, Netherlands (22 Sep 1975).

Thirty papers are presented concerning reactor dosimetry damage analysis; cross sections and benchmarks; unfolding; solid state track recording; and dosimetry materials. Twelve papers have been previously abstracted and indexed.

6685 (HEDL-SA—1144-A) **Damage correlation in theory and practice.** Doran, D.G.; Odette, G.R.; Simons, R.L.; Mansur, L.K. (Hanford Engineering Development Lab., Richland, Wash. (USA); California Univ., Santa Barbara (USA); Oak Ridge National Lab., Tenn. (USA)). 1977. Contract EY-76-C-14-2170. 22p. (CONF-770641—9). Dep. NTIS, PC A02/MF A01.

From Conference on radiation effects in breeder reactor structural materials; Scottsdale, Arizona, United States of America (USA) (19 Jun 1977).

Common to all reactor development work is the problem of differences between the irradiation environments used for materials testing and those typical of service conditions. Efforts are being made to develop damage models that incorporate irradiation parameters such as type and energy of radiation, flux, and exposure. Models relating radiation damage production and microstructural evolution to changes in mechanical properties are primitive. Nevertheless, they suggest that the inability to account quantitatively for differences in test and service neutron spectra leads to overly conservative design of out-of-core components. Direct experimental corroboration is difficult because of the low neutron fluxes associated with the desired soft spectra. Further development of mechanistic models and new approaches to model testing are needed. Models of the growth stage of swelling, on the other hand, are relatively advanced. These models are discussed briefly as an example of how damage models can be used to help guide and analyze irradiation experiments. Accelerated damage studies using charged particles are expected to continue. Current empirical correlations of damage rates can be given a firmer theoretical basis as analysis of experiments and modeling of damage continue to improve. Damage correlation methodology practices in reactor design must necessarily follow different rules from that practiced in materials research and development. Nevertheless, decreasing the gap between them is a laudable objective with potentially significant economic impact.

6686 (ORNL/TM—5228) **Fang angular folding code for channel theory analysis.** Williams, M.L.; Sadler, F.B. (Oak Ridge National Lab., Tenn. (USA)). Aug 1977. Contract W-7405-ENG-26. 48p. Dep. NTIS, PC A03/MF A01.

The development of the FANG code for performing channel analysis is documented. An input description is provided for users, as well as a brief description of the basic channel theory concepts. A sample streaming problem is described, for which FANG input and output are given.

6687 **Underwater repair of nuclear reactors.** Manry, L.V. Jr.; Peters, J.D. (Ocean Corp). *Power Eng.;* **81**: No. 7, 66-68(Jul 1977).

Traditional practice in the repair of nuclear reactors has been to dewater the reactor vessel when workers have to go inside for the repair operation, or for inspections. A new practice is to use underwater technicians without dewatering the vessel. This provides decisive advantage in safety, time, and cost. Most important is the reduction in radiation exposure because the water attenuates the radiation emanating from the vessel itself. Data collected to date show that radiation doses received by underwater technicians doing inspection and maintenance inside reactor vessels have been kept one or two orders of magnitude below what individuals would obtain in a dewatered vessel. This is in spite of the fact that underwater technicians spend 10 to 15 times as much time inside the reactor vessel; in fact, the underwater technicians pick up less radiation than surface support workers.

6688 **Deposition of magnetite particles from high velocity water onto isothermal tubes.** Burrill, K.A. Chalk River, Ont.; Atomic Energy of Canada Ltd. (Feb 1977). 31p.

The deposition rate of magnetite particles from a high-velocity water slurry onto isothermal metal tubes was measured. The effects of velocity (5 to 100 m/s), slurry concentration (200 to 1000 mg Fe/kg H$sub 2$O), temperature (25$degree$ to 90$degree$C), pH (4 to 10 at 25$degree$C), and tube material (nickel, Zircaloy-4) on deposition rate were studied. The data are interpreted in terms of two steps in series for deposition: a mass transfer step followed by a deposition or "inertial coasting" step. Mass transfer of particles through the bulk water phase apparently limits the deposition of particles at high Reynolds number (10$sup 5$). 13 refs.

6689 **Rules for construction of nuclear power plant components--division 1--division 2 general requirements.** New York; American Society of Mechanical Engineers (1977). 107p.

The rules of this section constitute the requirements for the construction of nuclear power plant items such as vessels, storage tanks, piping systems, pumps, valves, core support structures, and component supports, for use in, or containment of, the nuclear power system of any power plant. Covers the general requirements for manufacturers, installers, constructors, fabricators, materials manufacturers and suppliers, and for owners of nuclear power plant components including requirements for Code symbol stamping, inspector's duties and quality assurance. These general requirements were formerly articles NA-1000 through NA-8000 of Division 1, and articles CA-1000 through CA-8000 of Division 2.

6690 **Rules for construction of nuclear power plant components--division 1--subsection ng. core support structures.** New York; American Society of Mechanical Engineers (1977). 103p.

This section contains the rules for design, fabrication and testing of class CS core support structures. Core support structures are those structures or parts of structures designed to provide direct support or restraint of the core (fuel assemblies) within the reactor pressure vessel. Requirements for new construction are provided as well as experimental stress analysis, consideration of mechanical and thermal stresses due to cyclic operation; and nondestructive acceptance standareds are included.

6691 **Rules for construction of nuclear power plant components--division 1--subsection nf. component supports.** New York; American Society of Mechanical Engineers (1977). 77p.

This section contains the rules for design, fabrication, construction and testing of Class 1, 2, 3 and MC component supports (anchors, guides, restraints, rolling or sliding supports, rod type hangers, support spring hangers, snubbers, sway braces and vibration dampeners, integral and nonintegral structural attachment such as ears, shoes, lugs, rings, clamps, slings, straps, and clevises). Also includes experimental stress analysis and nondestructive acceptance standards, and provides requirements for new construction and consideration of mechanical and thermal stresses due to cyclic operation.

6692 **Rules for construction of nuclear power plant components. division 1--subsection ne. class mc components.** New York; American Society of Mechanical Engineers (1977). 145p.

This section contains the rules for design, fabrication, constructing and testing of class MC components. Includes experimental stress analysis and nondestructive acceptance standards, and provides requirements for new construction and consideration of mechanical and thermal stresses due to cyclic operation.

6693 **Studies in reliability. Part A. Single-component failure/repair. Part B. Nuclear containment reliability via Monte Carlo.** Grzesik, J.A. Los Angeles; Univ. of California (1977). 642p. Microfilms Order No. 77-19,632.

Thesis (Ph. D.).

The dissertation at hand blends into the current climate of anxiety over safe operation for large-scale, particularly nuclear technology, and has for its motif a Monte Carlo, computer-based simulation for one peripheral aspect of power-plant service. The work is quantitative throughout, and is divided into two parts, A and B, allied by a common reliability flavor, but differing in their specific concerns. To Part A is assigned the double role of theoretical development for stochastic process evolution, and the setting of a general tone from which the safety application of Part B emerges as virtually natural extension. The process considered by Part A involves just one single, unspecified device meandering between alternate sojourns in function and disrepair, and having a recourse throughout to both warehouse replacement and a stochastically administered maintenance activity.

FUEL ELEMENTS

6694 (HEDL-TME—76-92) **Computerized x-ray radiographic system for fuel pellet measurements.** Green, D.R.; Karnesky, R.A.; Bromley, C. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Aug 1977. Contract EY-76-C-14-2170. 205p. .

The development and operation of a computerized system for determination of fuel pellet diameters from X-ray radiography is described. Actual fuel pellet diameter measurements made with the system are compared to micrometer measurements on the same pellets, and statistically evaluated. The advantages and limitations of the system are discussed.

6695 **Fuel storage rack.** Mollon, L. (to Brooks and Perkins, Inc.). US Patent 4,039,842. 2 Aug 1977. Filed date 8 Jan 1976. 6p.

Disclosed is a storage rack for spent nuclear fuel elements comprising a multiplicity of elongated hollow containers of uniform cross-section, preferably square,some of said containers having laterally extending continuous flanges extending between adjacent containers and defining continuous elongated chambers therebetween for the reception of neutron absorbing panels. 18 claims, 7 figures.

CONTROL SYSTEMS

6696 (HEDL-TME—77-33) **LMFBR reference control materials. Semiannual report, July—December 1976.** Roake, W.E.; Claudson, T.T. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Aug 1977. Contract EY-76-C-14-2170. 67p. .

Information is presented concerning improved absorber concepts, design and performance analysis, materials testing and characterization, neutron absorber performance monitoring, and fabrication development.

6697 (HEDL-TME—77-75) **Method for measuring differential control rod worth at power.** Sevenich, R.A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-14-2170. 25p. .

A method is presented for determining differential control rod worths for a reactor operating at power. The proposed measurement method requires that a control rod be run-in a short distance, dropping the reactor power by $< 3\%$. The resulting power history must be sampled at a fairly rapid rate, say 0.01-second increments, and have a 1σ noise component $< 2\%$ of the signal. The analytical technique does not require information about the feedback reactivity. Results of a variety of simulations are given with different noise levels and a full selection of initial control rod positions.

6698 **Detection of fuel rod leakage.** Worlton, D.C.; Robinson, D.L. (to Exxon Nuclear Co., Inc.). US Patent 4,039,375. 2 Aug 1977. Filed date 20 Jun 1975. 8p.

Nuclear reactor fuel rod leakage is determined by measurement of vibrational characteristics of a resilient, flexible means sealed within the upper end caps of the fuel elements. The flexible means, which is preferably a metallic diaphragm, is set into motion by the impact of an internal metal rod which is operated by an external magnetic field, thereby permitting an indication of the pressure inside a fuel element without disturbing the welded assembly. The metal rod is activated and the vibration measurements are made through the use of a special tool which fits near the end cap of the fuel element to be tested. 5 claims, 8 figures.

6699 **Bwr centralized monitor and control system, PODIA development.** Otaka, H.; Aoki, R.; Neda, T.; Koga, T. (Tokyo Shibaura Electr Co, At Power Div, Jpn). *Toshiba Rev., Int. Ed.;* No. 107, 6-9(Jan-Feb 1977).

In present BWR nuclear stations, centralized monitor and control are a generally accepted idea for central control room and radioactive waste system control room implementation. A nuclear station color crt display system consisting of two color crt displays and a process computer system for reactor core and plant performance evaluation, has been developed in the evolution of a central control room. This article introduces a monitor and control equipment set, consisting of ten color crt displays. The system is designated as a Plant Operation by Displayed Information and Automation (PODIA) system. It has a turbine-generator unit automatic start-up function. This setup assists major plant equipment operation by a single operator in sitting position.

6700 **Electrochemical treatment of internal built-up surfaces of large-size cowlings of nuclear power plant equipment.** Ryabchenko, N.N.; Pulin, V.Y. (Cent Sci Res Boiler and Turbine Inst, USSR). *Energomashinostroenie;* No. 4, 22-23(1977). (In Russian).

Results of investigations of electrochemical treatment of surfaces are presented. A technological scheme of treatment is chosen and results of tests of several electrolytes based on inorganic salts are presented. Conditions of stabilization of the process of treatment and geometric dimensions of the cathode are established. Results of technical and economic justification of the application of electrochemical treatment of the deposited anticorrosion layer of large-size cowlings are presented.

6701 **Human factors in the nuclear control room.** Seminara, J.L.; Pack, R.W.; Gonzalez, W.R.; Parsons, S.O. *Nucl. Saf.;* **18**: No. 6, 774-790(1977).

Human factors engineering is an interdisciplinary specialty concerned with influencing the design of equipment systems, facilities, and operational environments to promote safe, efficient, and reliable operator performance. The human factors aspects of five representative nuclear power-plant control rooms were evaluated using such methods as a checklist-guided observation system based on military standards, structural interviews with operators and trainers, direct observations of operator behavior, task analyses, procedure evaluations, and historical error analyses. The review has surfaced a wide spectrum of human factors problem areas and needed improvements. The study recommends that a detailed set of applicable human factors standards be developed to stimulate a uniform and systematic concern for human factors. It is further recommended that design guides be developed to facilitate the implementation of such standards both for new designs and for upgrading existing control rooms. A number of research areas are delineated in order to develop a more comprehensive data base on which to predicate human factors standards.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 6514, 7464

6702 (ERDA—1552) **Safety research experiment facilities, Idaho National Engineering Laboratory, Idaho. Final environmental impact statement.** Liverman, J.L. (Energy Research and Development Administration, Washington, D.C. (USA)). Sep 1977. 550p. NTIS, PC E08/MF E08.

This environmental statement was prepared for the Safety Research Experiment Facilities (SAREF) Project. The purpose of the proposed project is to modify some existing facilities and provide a new test facility at the Idaho National Engineering Laboratory (INEL) for conducting fast breeder reactor (FBR) safety experiments. The SAREF Project proposal has been developed after an extensive study which identified the FBR safety research needs requiring in-reactor experiments and which evaluated the capability of various existing and new facilities to meet these needs. The proposed facilities provide for the in-reactor testing of large bundles of prototypical FBR fuel elements under a wide variety of conditions, ranging from those abnormal operating conditions which might be expected to occur during the life of an FBR power plant to the extremely low probability, hypothetical accidents used in the evaluation of some design options and in the assessment of the long-term potential risk associated with wide-acale deployment of the FBR.

6703 **Power-plant discharges: toward more reasonable effluent limits on chlorine.** Mattrice, J.S. (Oak Ridge National Lab., TN). *Nucl. Saf.;* **18**: No. 6, 802-819(1977).

A method is presented for restricting chlorine in power-plant effluents to environmentally safe levels. Development of this method was stimulated by the controversy between electric utilities and regulatory agencies over the justification of the present universally applied limits. The scientific literature conclusivey demonstrates the effects of physical, chemical, and biotic factors on chlorine toxicity. The method proposed includes these factors, to the extent currently possible, to set limits based on site-specific aquatic conditions and plant design and operation specifications. In these effluent limits, the organisms considered are those which are entrained into the plume or which maintain themselves within the plume during chlorination. In each instance the time course of exposure concentration is divided into small time intervals. Weighted mean concentrations for successively larger time intervals following initial exposure are then calculated. Exposures resulting from releases at various levels are compared either graphically or mathematically with acute and chronic mortality thresholds to find the highest discharge concentration that does not cause mortality. The thresholds are derived from existing toxicity data and are different for marine and freshwater organisms. This method is based on the latest literature available and can incorporate further data concerning chemistry, toxicity, and behavior as they become available. The method also is amenable to coupling with models of chemical dispersion and population dynamics to permit more complete analysis. This approach serves to permit use of chlorine for biofouling control at power plants, while ensuring that this use will not be inimical to the environment.

RESEARCH, TEST, AND EXPERIMENTAL REACTORS

REFER ALSO TO CITATION(S) 6620, 6634, 6641, 6644, 6650, 6654, 6661, 6666, 6672, 6696, 6702, 6716, 6724, 6782, 6797, 6806, 7203

6704 (ANL—77-58) **Scintillation spectrometer system for measuring fast-neutron spectra in beam geometry.** Simons, G.G.; Larson, J.M.; Reynolds, R.S. (Argonne National Lab., Ill. (USA)). May 1977. Contract W-31-109-ENG-38. 38p. Dep. NTIS, PC A03/MF A01.

A high-energy liquid-organic scintillation spectrometer system is described. This spectrometer was developed to measure neutron spectra in extracted beams from zero-power fast reactors. The highly efficient NE-213 scintillation solution was used as the neutron detection medium. Identification and removal of gamma-ray-induced events was accomplished using electronic pulse shape discrimination. Instrumentation used to process the discrete pulses stemming from neutron and gamma-ray interactions, within the scintillation solution, is described in detail. Evaluation of the system's performance is discussed for a gamma-ray discrimination ratio of nominally 1000:1, a total countrate of 3000 cps, and a dynamic range corresponding to neutron energies from 1 to 10 MeV. Operation above 10 MeV is certainly possible. However, since the neutron flux above 10 MeV was negligible in the radiation fields of interest in this work, the operating characteristics of the spectrometer were not evaluated above 10 MeV. Neutron spectra are reported for extracted beam measurements made on ZPPR assembly 4, phase 2.

6705 (HEDL-TME—76-4) **Liquid velocity measurements in outlet plenum of FFTF hydraulic core mockup.** Dickinson, D.R. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1977. Contract EY-76-C-14-2170. 87p. .

Liquid velocities were measured in the outlet plenum of the Hydraulic Core Mockup, which is a 0.285-scale hydraulic water model of the Fast Test Reactor, using three-dimensional pitot probes. Velocities (at FTR conditions) were 6 to 13 ft/sec upward over the core, 1 to 2 ft/sec radially outward below the vortex suppression plate, and 1 to 3 ft/sec downward along the vessel wall.

6706 (HEDL-TME—77-20) **Thermal performance tests of the FFTF closed loop cold trap.** Blair, C.K.; Bloom, G.R. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Aug 1977. Contract EY-76-C-14-2170. 100p. .

The three gpm FFTF Closed Loop Cold Trap was tested to demonstrate thermal performance of the economizer and gas cooled crystallizer. Sodium and gas stream temperature profiles were measured and confirmed with heat balance calculations over the expected operating range. The trace heat system design adequacy was also tested.

6707 (HEDL-TME—77-63) **Removal of sodium from the IVHM orientation plug.** Crippen, M.D. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Aug 1977. Contract EY-76-C-14-2170. 16p. .

A replica of the FFTF In-Vessel Handling Machine—Engineering Model (IVHM-EM) orientation plug was cleaned of sodium. It was demonstrated that cleaning time could be substantially reduced by either raising the moisture content of the water vapor-nitrogen gas or pressure cycling the reacting gas or both. The plug was repeatedly cleaned without damage.

6708 (HEDL-TME—77-77) **Dimensional analysis of FFTF driver fuel assemblies.** Bunker, M.S.; Carlson, R.L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-14-2170. vp. .

Dimensional analysis is performed on Fast Flux Test Facility (FFTF) driver fuel assemblies using a computer program called DUCKT. The program takes dial indicator readings from a dimensional gage, models a hexagonal column in three dimensions; and compares the resultant model against acceptance criteria for twist, offset, and centerline alignment, or bow. The document describes the mathematical derivation of the DUCKT calculations, the benchmark tests conducted prior to implementation, the techniques governing measurement, and the acceptance procedure.

6709 (IWGFR—5, pp 25-29) **Fuel failure on the Rapsodie subassembly 'Capricorn 1.b'.** Chalony, A.; Chantoin, P.; Cauvin, J.C.; Pages, J.P. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

Fuel pin failure in a 3-pin experimental subassembly in RAPSODIE is described. The location, removal, and post-irradiation examination of the subassembly is described and the postulated failure mechanism is discussed.

6710 (NP—22477) **GETR technical specifications.** (General Electric Co., Pleasanton, Calif. (USA). Vallecitos Nuclear Center). Jul 1977. 52p. Electric Co., Pleasanton, CA.

Information on the GETR technical specifications is presented concerning definitions, safety limits and limiting safety system settings, limiting conditions for operation, surveillance requirements, design features, and administration.

6711 (ORNL/TM—6063) **High flux isotope reactor. Quarterly report, April—June 1977.** Corbett, B.L.; McCord, R.V.; Poteet, K.H. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 20p. Dep. NTIS, PC A02/MF A01.

Routine reactor operation with four end-of-cycle shutdowns resulted in an on-stream time of 96.6%. The control plates were changed, and the No. 2 drive rod was replaced. Leaks have occurred in two primary heat exchangers, probably as a result of the 100 psi increase in system operating pressure. A brief electrical power outage (less than two seconds) was weathered without a reactor scram occurring--the control system worked as designed to maintain operation. Basic operating data for the quarter are listed.

PLUTONIUM AND ISOTOPE PRODUCTION REACTORS

REFER ALSO TO CITATION(S) 6671

6712 (UNI—105-A) **Decontamination of 109 cell primary cooling system piping. Final report.** Hall, T.M.; Kratzer, W.K. (Boston Coll., Chestnut Hill, Mass. (USA). Mass Space Data Analysis Lab.). 16 Mar 1976. Contract EY-76-C-06-1857. 7p. Dep. NTIS, PC A02/MF A01.

The objective of this production test was to determine the decontamination effect of recirculating primary coolant in a shutdown 109-N cell at lower than normal pH while maintaining a high rate of feed and bleed. The procedure was applied to four of the 109-N cells during the period December 1973 through December 1974. Prior to and following each decontamination, radiation surveys were made at specified locations in order to measure any effects that might occur. Cell radiation readings were lower following each of the low pH flushes performed, although the change was rather insignificant. The main purpose of the low pH flush was to attempt to reduce the "hot speck" inventory in the primary coolant piping.

REACTOR SAFETY

REFER ALSO TO CITATION(S) 7240

6713 (AI-ERDA—13205) **LMFBR safety program. Quarterly technical progress report, April—June 1977.** Heisler, M.P.; Johnson, R.P.; Nelson, C.T.; Vaughan, E.U.; Guderjohn, C. (Atomics International Div., Canoga Park, Calif. (USA)). 31 Aug 1977. Contract EY-76-C-03-0824-010. 24p. Dep. NTIS, PC A02/MF A01.

Progress is summarized in LMFBR safety studies related to the characterization of sodium fires and fission products. Included are sections on sodium jet dispersal, aerosol leakage, high temperature-concentration aerosols, characteristics of released aerosols, and SOMIX code development. (DG)

6714 (ANL—77-69) **Physics of reactor safety. Quarterly report, April—June 1977.** (Argonne National Lab., Ill. (USA)). Sep 1977. Contract W-31-109-ENG-38. 47p. Dep. NTIS, PC A03/MF A01.

The work in the Applied Physics Division includes reports on reactor safety program by members of the Reactor Safety Appraisals Group, Monte Carlo analysis of safety-related critical assembly experiments by members of the Theoretical Fast Reactor Physics Group, and planning of safety-related critical experiments by members of the Zero Power Reactor (ZPR) Planning and Experiments Group. Work on Reactor core thermal-hydraulic code development performed in the Components Technology Division is also included in the report.

6715 (ANL-CT—77-17) **Analysis of thermal fluctuations in the semiscale tests to determine flow transit delay times using a transfer function cross-correlation technique.** Raptis, A.C.; Popper, G.F. (Argonne National Lab., Ill. (USA)). Aug 1977. Contract W-31-109-ENG-38. 32p. Dep. NTIS, PC A03/MF A01.

On April 14, 1976, EG and G performed the Semiscale Blowdown 29-1 experiment to try to establish the feasibility of using a transit time flowmeter (TTF) to measure transient blowdown two-phase flow rates. The recorded signals from that experiment were made available to and analyzed by the Argonne National Laboratory using the transfer function cross-correlation technique. The theoretical background for the transfer function method of analysis and the results of the data analysis are presented. Histograms of transit time

during the blowdown are shown and topics for further investigation are identified.

6716 (ANL-RDP—61) **Reactor Development Program progress report, May—June 1977.** (Argonne National Lab., Ill. (USA)). 11 Aug 1977. Contract W-31-109-ENG-38. vp. .

Progress is summarized in the following research and development areas: Experimental Breeder Reactor No. II (EBR-II), LMFBR Design Support, Instrumentation and Control, Fuels and Materials Development, Reactor Physics, Reactor Safety, and Gas Cooled Fast Breeder Reactors.

6717 (BMI-NUREG—1979) **Steam-water mixing and system hydrodynamics program. Task 4. Quarterly progress report, April 1, 1977—June 30, 1977.** Carbiener, W.A.; Cudnik, R.A.; Dykhuizen, R.C.; Denning, R.S.; Flanigan, L.J.; Carr, J.A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1977. vp. NTIS.

Experimental studies were conducted in a 2/15-scale model of a four-loop pressurized water reactor at pressures to 75 psia to extend the understanding of steam-water interaction phenomena and processes associated with a loss-of-coolant accident. The initial test series in this facility was completed which consisted of quasi-steady penetration tests. Additionally, plenum filling studies with and without hot walls and no cold leg steam were completed. Preliminary analyses of these data indicate that results obtained from both modes of testing, quasi-steady penetration with lower plenum draining and plenum filling, provide similar results which can be used to develop downcomer penetration correlations and to compare results from tests conducted in either operational mode. Comparisons of 1/15- and 2/15-scale data show that fluid behavior in both sizes is similar in that the observed effects on downcomer penetration of core steam flow, system pressure, ECC flow, and ECC water subcooling are common to both systems. The 1/15 and 2/15 data are compared using the j^* or flooding parameters as the scaling basis. Although the comparisons appear to show good agreement, analyses indicate that a statistically significant difference exists in the data. This difference is being examined further. Two different forms are examined for correlating the combined sets of 2/15- and 1/15-scale data. Statistical tests were used to select the most appropriate form. Comparisons of data and correlational outputs are presented for both sized systems to illustrate the degree of data representation.

6718 (BN-TOP—3(Rev.4)(Draft)) **Performance and sizing of dry pressure containments.** (Bechtel Power Corp., San Francisco, Calif. (USA)). Oct 1977. 180p. Power Corp., San Francisco, CA.

Functional design and accident performance characteristics of dry pressure containments are established using analytical techniques and design parameter selection methods adopted by Bechtel Power Corporation for light-water reactor nuclear power plant containments. The analytical techniques employed to predict thermodynamic performance during postulated loss-of-coolant accidents and steam line breaks and the models and assumptions treated in the Bechtel containment analysis computer program COPATTA are given. A typical pressurized water reactor containment transient is analyzed to illustrate the methods established. Parametric studies are provided to demonstrate the sensitivity of the containment performance to certain input parameters.

6719 (BN-TOP—4(Rev.1)) **Responses to regulatory positions on BN-TOP—4.** Kniel, K. (Bechtel Power Corp., San Francisco, Calif. (USA)). 1977. vp. Power Corp., San Francisco, CA.

The analytical techniques used to predict pressure and temperature histories in subcompartments following postulated pipe breaks are described. The multiple compartment computer code, COPDA, is described in detail along with criteria for subcompartment modeling.

6720 (BNWL—2279) **Quarterly progress report to Nuclear Regulatory Commission, Division of Reactor Safety Research, Fuel Behavior Research Branch programs for period ending March 1977.** Bailey, W.J. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1977. Contract EY-76-C-06-1830. 208p. Dep. NTIS, PC A10/MF A01.

Information is presented concerning experimental verification of steady-state fuel behavior codes program, fuel subassembly procurement and irradiation test program, and pressure transducer development program.

6721 (CONF-761001—P2) **Fast reactor safety and related physics. Volume II. Licensing; safety-related design.** (American Nuclear Society, Chicago, Ill.; European Nuclear Society, Petit-Lancy (Switzerland)). 1976. Contract W-31-109-ENG-38. 522p. Dep. NTIS, PC A23/MF A01.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

Separate abstracts were prepared for 36 of the 49 papers included. Abstracts for the remaining papers have previously appeared in ERA.

6722 (CONF-761001—P2, pp 369-387) **LMFBR accident energetics and their role in licensing.** Speis, T.P. (Nuclear Regulatory Commission, Washington, DC); Denise, R.P.; Starostecki, R.W.; Lois, L.; Meyer, J.F.; Theofanous, T.G. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

The role of core disruptive accidents in the licensing of LMFBR's is addressed, in particular as it relates to the Clinch River Breeder Reactor. The evolution of the Nuclear Regulatory Commission's containment design requirements is discussed and the technical basis for its present position reviewed. The initiators considered for energetic core disruption are loss-of-flow (LOF) and transient overpower (TOP) both without scram. In addition to considering the immediate mechanical disassembly potential from these initiators, the potential for recriticality during meltdown phases is also assessed. The loss-of-flow cases are given particular attention because of the apparent potential for significant energetics.

6723 (CONF-761001—P2, pp 388-399) **Safety related design philosophy and experience of the experimental fast reactor "JOYO".** Matsuno, Y.; Maeda, K.; Inoue, T.; Kodaira, K. (Power Reactor and Nuclear Fuel Development Corp., Ibaraki Japan). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

Construction and installation of "JOYO", the first experimental fast breeder reactor of Japan is finished in the end of 1974, except for some modifications which have to be made due to the results of final check and review of the design carried out before the initial sodium charging into the system. In this paper a general description about "JOYO" plant, safety design philosophy and some modifications mentioned above are presented.

6724 (CONF-761001—P2, pp 400-410) **Resolution of key safety-related issues in FFTF regulatory review.** Simpson, D.E. (Westinghouse Hanford Co., Richland, WA). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

The FFTF is an ERDA facility which does not require licensing, but a technical review by NRC is required by ERDA policy. Safety issues which were not fully resolved in the course of the review for construction authorization have been the subject of continuing review since mid-1973. These issues included HCDA energetics, design fallback provisions for additional safety margins, piping integrity, and natural circulation core cooling.

6725 (CONF-761001—P2, pp 411-419) **Development of technical specifications for EBR-II: some considerations for application to commercial LMFBR's.** Sackett, J.I.; Gale, N.L. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

Considerations made in development of Technical Specifications for EBR-II identified operational-safety concerns unique to LMFBR's and applicable to both major reactor test facilities and prototype commercial plants. This effort highlighted the fact that to be useful, such documents must be prepared with a clear understanding of purpose and application. The necessary difference in purpose of these documents for different reactor applications is not widely recognized. For commercial reactors, the form and application of these documents has gone through significant evaluation. The Technical Specifications developed for EBR-II define the safe operating envelope while at the same time providing the flexibility to accommodate a wide range of tests relevant to fast reactor safety. This required, in many cases, definition of performance criteria rather than specific operating limits. Much consideration was given to differentiating between items truly relevant to personnel safety and those relevant only to reactor availability.

6726 (CONF-761001—P2, pp 420-430) **Designing for safety in fast reactors in the presence of uncertainties.** Cave, L.; Ilberg, D.; Okrent, D. (Univ. of California, Los Angeles). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

Topics discussed include safety requirements for fast reactors, sources of uncertainty in the demonstration of high reliability requirement in reactor systems, and possible means of limiting the risk from pressure-driven core disassembly accidents.

6727 (CONF-761001—P2, pp 442-451) **Decay heat removal plan of the SNR-300: a licensed concept.** Morgenstern, F.H.; Gyr, W.; Stoetzel, H.; Vossebrecker, H. (INTERATOM, Bensberg, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

The report describes how the decay heat removal plan of the SNR-300 has been established in 3 essential licensing steps, thus giving a very significant example for the slow but steady progress in the overall licensing process of the plant. (1) Introduction of an ECCS in addition to the 3 main heat transfer chains as a back-up for rather unlikely and undefined occurrences, 1970; (2) Experimental and computational demonstration of a reliable functioning of the in-vessel natural convection of the fluid flow, 1974; and (3) Proof of fulfilling the general safety and specific reliability criteria for the overall decay heat removal plan; i.e., the 3 main heat transfer chains with specific installations on the steam/water system side and the ECCS, 1976. Some special problem areas, for instance the cavity concept provided for the pipe fracture accident, have still to be licensed, but they do not contribute considerably to the overall risk.

6728 (CONF-761001—P2, pp 452-459) **Design requirements for the SNR-300 containment system.** Oeynhausen, H.; Morgenstern, F.; Scholle, U.; Lange, L.; Waldhoer, G. (INTERATOM, Bensberg, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

The essential design data of the SNR-300 containment system were derived from the results of analyses of the Bethe-Tait-Accident (hypothetical core disruption). The thermodynamic loads to be expected after a Bethe-Tait-excursion are carried by the inner containment. The confinement of the activity released following a Bethe-Tait-excursion is achieved by use of a reventing system in the outer containment. The essential results of the thermodynamic analysis are given as well as the design data of the system. The results of the aerosol-physical analysis are discussed with regard to their importance for the safety of the auxiliary equipment. The radiological considerations following an accident place special requirements upon the containment design. The radiological safety of the equipment is shown, even in the extreme case when active heat sinks are neglected.

6729 (CONF-761001—P2, pp 463-472) **Comparison of neutronics calculations in a loss-of-flow accident.** Schaefer, R.W. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

Results of a study of the accuracy of point kinetics reactivity predictions for loss-of-flow transients in a CRBR model are presented. Neutronics calculations were driven by realistic material and temperature histories representative of the thermal-hydraulic feedback which occurs in this type of transient. Reactivity solutions from 3 point kinetics variations and the quasistatic method are compared. One variation is found to be superior to the others for these transients; its prediction at power burst conditions is low by approximately $0.35. Accurate quasistatic neutronics calculations are found to have small CPU requirements relative to the time required for thermal-hydraulic calculations with SAS.

6730 (CONF-761001—P2, pp 473-481) **Assessment of transport effects in LMFBR safety neutronics.** Cahalan, J.E. (Purdue Univ., Lafayette, IN); Ott, K.O.; Ferguson, D.R. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

A qualitative and quantitative assessment of the significance of neutron transport effects in LMFBR core disruptive accident analysis is presented. Material relocations which might cause important neutron transport behavior are identified. A quantitative measure of the error in the neutron flux is obtained from a consistent numerical comparison of transport and diffusion theory eigenvalue solutions for models of disrupted cores. A numerical technique for the prediction of transport eigenvalues and eigenvectors is formulated and applied. The technique is based on a modified diffusion theory which is fully capable of reproducing transport theory solutions.

6731 (CONF-761001—P2, pp 482-491) **Neutronic coupling of feedback effects.** Malloy, D.J.; Ott, K.O. (Purdue Univ., Lafayette, IN). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. II.

The currently applied feedback methodology has been extended by explicitly treating the coupling effect which exists between the various feedback components and by improving the description of the temperature dependence of the Doppler feedback. The Doppler and sodium void feedback and coupling coefficients are presented as a first comparison of the improved and the currently applied methods. Further, the energy release which results from hypothetical disassembly accidents is simulated with a special response surface (based upon VENUS-II results) in the parametric safety evaluation code PARSEC. Additionally, the probability distribution for available work-energy, which results from the statistical uncertainty of the Doppler coefficient, is calculated. The improved feedback methodology yields about a 16 percent higher average value for the work-energy. A substantially larger increase is found on the high-yield end of the spectrum: the probability for work-energy above 500 MJ is increased by about a factor of ten.

6732 (CONF-761001—P3) **Fast reactor safety and related physics. Volume III. Accident analysis; structural dynamics.** (American Nuclear Society, Chicago, Ill.; European Nuclear Society, Petit-Lancy (Switzerland)). 1976. Contract W-31-109-ENG-38. 580p. Dep. NTIS, PC A25/MF A01.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

Separate abstracts were prepared for 41 of the 56 papers included. Abstracts for the remaining papers have previously appeared in ERA.

6733 (CONF-761001—P3, pp 877-884) **CEC activities in the field of LMFBR safety.** Balz, W.; Finzi, S.; Klersy, R. (Joint Research Centre, Ispra, Italy). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

The aim of the ECC is to reach a common LMFBR Safety strategy in Europe. To this end the Commission promotes collaboration between the different fast reactor projects in the Community through working groups and collaborative arrangements and contributes with a research activity executed in its Joint Research Centre Ispra. A short description is given of the activity in the working groups and of the Ispra programme on LMFBR Safety. This programme covers: LMFBR thermohydraulics, fuel coolant interactions, dynamic structure loading and response, safety related material properties and whole core accident code development.

6734 (CONF-761001—P3, pp 885-894) **Method for assessing core-wide incoherency effects on LMFBR whole-core accident evolution.** Massey, J.V.; Lois, L.; Speis, T.P.; Theofanous, T.G. (Purdue Univ., Lafayette, IN). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

A technique for the evaluation of the effects of core-wide incoherencies on the CRBRP unprotected Loss-of-Flow accident scenario has been presented. It appears that core-wide incoherencies result in increased core voiding and hence less sodium reactivity inventory, at the inception of LOF-d-TOP conditions. The approach to this condition is also governed by substantially lower ramp rates. Finally the post failure phenomena when treated with the degree of incoherency physically present, yield substantially milder super prompt critical conditions.

6735 (CONF-761001—P3, pp 905-914) **Assessment of fuel failure propagation in LMFBRs.** Fauske, H.K.; Grolmes, M.A.; Chan, S.H. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

The potential for subassembly disruption as well as the consequences thereof have been examined for an oxide-fueled liquid metal cooled fast breeder reactor. Based upon credible initiators, it has not been possible to identify any sequence of events which could result in subassembly disruption prior to detection and shutdown of the reactor. The principal reasons for this conclusion are: (1) local faults have been previously shown to be isolated events and; (2) slow blockage propagation appears non-mechanistic. Furthermore, even if subassembly meltdown is postulated to occur in the absence of scram, it was concluded that significant damage beyond the incident subassembly also appears unlikely. Finally, even if extensive whole-core involvement is postulated, the level of accident energetics is assessed to be insufficient to breach the primary containment. The principal reasons for the "benign" character of the consequences following postulated fuel disruption are attributed to the inherent dispersive nature of the heat generating fuel and the lack of satisfying the necessary requirements for large mass vapor explosions with the oxide-fuel-sodium system. These characteristics can be used in a general way to rule out early mechanical damage to the core and significant propagation beyond the incident subassembly due to radial meltthrough, as well as prompt critical conditions due to sodium voiding and recriticality events.

6736 (CONF-761001—P3, pp 915-925) **Depressurization accident studies for GCFR's.** Buttemer, D.R.; Chung, H.S. (General Atomic Co., San Diego, CA). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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Aspects of depressurization accidents have been analyzed for the 300 MWe Gas-Cooled Fast Breeder Reactor (GCFR) demonstration plant which employs 1300 psia (9 MPa) helium as the primary coolant. The coolant loops and major reactor internal components are housed in the prestressed concrete reactor vessel (PCRV). Although extremely improbable, the current GCFR design basis depressurization accident is caused by the seal failure of a large penetration closure which results in a 75 square inch free flow leak area open to the reactor containment building. The depressurization accident was analyzed with two models: (1) the best estimate model which is defined by the use of expected system performance characteristics, and (2) the conservative model which is defined by incorporating uncertainty margins in the performance parameters for the cooling system components. The results of the analyses indicate that the maximum hot spot cladding temperature developed in the core is 1520°F (827°C) using the best estimate model with three cooling loops operating. The maximum hot spot cladding temperatures calculated with the conservative model with three or two auxiliary loops operating are 1930°F (1054°C) and 2290°F (1254°C), respectively. With pressure equalized fuel rods, the cladding temperature safety limit is expected to be near the 2500°F (1371°C) melting temperature for stainless steel. The thermal response of the GCFR core after the depressurization accident has also been examined with respect to the specific effects of containment back pressure, air ingress and the size of the depressurization leak area.

6737 (CONF-761001—P3, pp 926-935) **Computational analysis of fuel—sodium interactions with an improved method.** Jacobs, H. (Kernforschungszentrum, Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

A new fuel-sodium interaction model programmed as the MURTI code is presented. Owing to a more rigorous treatment of the heat fluxes within fuel and sodium in connection with a space and time-dependent description of the coolant state, it is more generally applicable than the models used so far. Furthermore in this model the region of interaction may be subdivided which enables a very flexaible description of thermal interactions. It is demonstrated that most of the presently used models adequately describe only interactions with strong intermixing of fuel and sodium. In a case with only poor intermixing MURTI predicts early vaporization and the formation of a vaporous layer at the fuel surface while the remaining coolant acts as a heat sink only. Furthermore the MURTI code is applied to study thermal detonations as hypothesized by Board and Hall. It is found that an interaction with pressures far below the level of stable propagation can escalate by itself, if appropriate conditions are encountered.

6738 (CONF-761001—P3, pp 936-943) **Probabilistic analysis of accidental transients in a LMFBR.** Amesz, J. (EURATOM, Ispra, Italy); Volta, G.; Cesari, F.; Righini, R. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The temperature transients at a defined primary circuit point of the fast reactor PEC have been analyzed using an approach already applied to the analysis of PWR pressure transients. The aim of this analysis is to assess the probability distribution of loads acting on the reactor primary circuit. According to this approach the expected number of various initiating events during the life-time of the reactor is firstly evaluated. Then the availability of the engineered safety features is assessed. Finally for each possible accidental state the temperature transient is computed. The first and the second step in a first approximation has been carried out using a semiprobabilistic method based on probability indices. In a second phase a detailed probabilistic analysis has been implemented using fault-tree techniques and sensitivity analysis. The third step, deterministic, consists of the computation of temperature transients by dynamics codes. The analysis presented here has involved the consideration of 30 initiating events and 17 engineered safety features, the enormous number of possible accidental states has been drastically reduced in various considerations based on intrinsic non compatibility of some combinations, finally 93 transients have been retained and used to define the temperature transients distribution.

6739 (CONF-761001—P3, pp 947-957) **Effect of failure incoherence in a LMFBR hypothetical overpower accident.** Royl, P.; Kuczera, B. (Kernforschungszentrum, Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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Incoherency effects due to the statistical nature of fuel rod failure have been assessed for transient overpower (TOP) accidents with different initiating ramp rates. Characteristic single subassembly feedbacks from sodium voiding, fuel injection, and fuel sweep out after failure were calculated and superimposed incoherently. Effective feedback functions were thus generated for characteristic subassembly groups (channels) and used as tabular reactivity input to corresponding multi-channel whole core TOP simulations using the HOPE computer model. Analyses were performed for the SNR-300 MARK 1A end of life (EOL) core with initiating ramp rates of 0.15, 0.5 and 5 $/sec. The results are compared with those from a calculation with coherent subassembly behavior in each channel. It is concluded for the mild transient: Irrespective of the assumed axial failure location, negative fuel sweep out reactivity from early failed subassemblies will prevent the accident from reaching a prompt critical stage and lead to a gradual shut down, if the assessed failure incoherencies are applied. For the higher ramp rates (greater than or equal to 0.5 $/sec) the assessed incoherencies will not always lead to an early shut down, but they can considerably reduce the potential to accumulate high ramp rates in the initiating phase of TOP accidents.

6740 (CONF-761001—P3, pp 958-968) **Analysis of LMFBR overpower accidents, including fission gas effects in the predisassembly and disassembly phase.** Bogensberger, H.G.; Fischer, E.A.; Royl, P.; Arnecke, G. (Kernforschungszentrum, Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The analysis of unprotected TOP accidents for an irradiated LMFBR core with the codes HOPE and KADIS was improved in two different ways: First, an existing fission gas behavior model was further developed to include a simulation of transient gas release. This model was used to check, and to improve the analysis of the gas behavior during steady state, and also in the predisassembly and disassembly phase of the accident. The effect of transient gas release before melting, which is predicted for a mild TOP, has been simulated in HOPE by adjusting the corresponding gas release parameters. In KADIS, a new equation of state, including fission gas effects, was introduced. Case studies were carried out for the EOL core of the SNR300. For accidents with different ramp rates, pin failure was assumed to occur in the axial peak node, at the onset of unrestructured fuel melting. These cases all lead to energetic core disassemblies and demonstrate the shutdown potential of the fission gas pressure under rather pessimistic conditions. In addition, the influence of transient gas release below the solidus was studied, in connection with a mechanical failure criterion. With this more realistic criterion, the accident is much milder. Gas release below the solidus did not greatly change the overall accident sequence; especially, it did not lead to more coherent failure of the channels, which would be associated with higher energy release.

6741 (CONF-761001—P3, pp 979-987) **EPIC: a computer program for fuel-coolant interactions.** Pizzica, P.A.; Abramson, P.B. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

EPIC models fuel and coolant motions which result from internal fuel pin pressure (from fission gas or fuel vapor) and/or from the generation of sodium vapor pressures in the coolant channel subsequent to pin failure in an LMFBR. The modeling includes the ejection of molten fuel from the pin into a coolant channel with any amount of voiding through a clad rip which may be of any length or may expand with time. One-dimensional Eulerian hydrodynamics is used to model both the motion of fuel and fission gas inside a molten fuel cavity and the mixture of two-phase sodium and fission gas in the channel. Motion of molten fuel particles in the coolant channel is tracked with a particle-in-cell technique.

6742 (CONF-761001—P3, pp 1027-1036) **Safety issues for advanced-fueled LMFBRs.** Rose, D.; Deitrich, L.W.; Grolmes, M.A.; Ferguson, D.R. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The safety issues for LMFBRs fueled with the candidate advanced-fuels, particularly for commercial size reactors, are reviewed and comparisons drawn with oxide-fueled fast reactors. The extent to which the difinition and resolution of safety issues for advanced-fueled reactors draws on the current level of understanding for oxide-fueled reactors is highlighted. Areas of technology in which work is required and underway to resolve the safety issues are also highlighted.

6743 (CONF-761001—P3, pp 1057-1066) **Central computerized data base for liquid metal fast breeder reactor safety codes.** Alter, H. (Energy Research and Development Administration, Washington, DC); Flanagan, G.F.; Greene, N.M. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

The majority of safety computer codes used in the Liquid Metal Fast Breeder Reactor (LMFBR) safety studies have been developed with funds provided by the Energy Research and Development Administration (ERDA). Currently, the data used by these

codes are collected by each user who must transcribe it for use in his study. This procedure, unfortunately, involves redundant effort and many times requires the user to "evaluate" physical property data, even though he has no expertise in this area. The Safety Analysis Computerized Reactor Data (SACRD) effort has been initiated to alleviate many of the difficulties cited above.

6744 (CONF-761001—P3, pp 1069-1080) **Influence of fuel-coolant-interactions on loss of flow type core disruptive accidents for the SNR-300.** Essig, C.; Froehlich, R.; Schmuck, P. (Kernforschungszentrum, Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The influence of fuel-coolant-interactions (FCIs) on loss of flow type core disruptive accidents has been studied for the fresh and irradiated (end of third cycle) SNR-300 Mark 1A cores. For the fresh core two accident simulations (without and with axial expansion reactivity feedback) have been considered. For these simulations it has been shown that FCIs must only be considered for the disassembly phase of the accident and these FCIs do not lead to dangerous implosive effects. The highest energy releases are obtained if FCIs are neglected. For the irradiated core the accident has been simulated without axial expansion reactivity feedback. FCIs during the disassembly phase do not lead to dangerous implosive effects. Unfortunately, for an irradiated core, pin failures and FCIs cannot be excluded during the predisassembly phase of the accident. These phenomena are discussed and several reasons are given which lead to the conclusion that these failures and FCIs during the predisassembly phase have rather limited consequences for the irradiated SNR-300 core considered.

6745 (CONF-761001—P3, pp 1081-1090) **Unprotected loss-of-flow transients in large LMFBRs.** Tzanos, C.P.; Barthold, W.P.; van Erp, J.B. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The dependence of the time to reach sodium boiling in an unprotected loss-of-flow transient in large LMFBRs on sodium density reactivity, radial thermal core expansion, and flow decay characteristics has been investigated. From the results obtained it appears to be possible to avoid sodium boiling completely if the following features, achievable within practical design limits, are incorporated (a) extended flow coastdown, (b) enhanced negative reactivity feedbacks due to radial thermal core expansion, (c) reduced positive reactivity feedbacks due to sodium density changes and the Doppler effect, (d) enhanced coolant flow due to natural circulation.

6746 (CONF-761001—P3, pp 1091-1100) **Treatment of incoherencies and uncertainties in LMFBR LOF accident analysis with PARSEC.** Burns, R.D. III; Ott, K.O. (Purdue Univ., Lafayette, IN). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

As basis for an investigation of the parameter and model uncertainties as well as of inter-subassembly incoherency effects, a computer program, PARSEC (Parametric Safety Evaluation Code) is being developed at Purdue University. The basic features of the first version, PARSEC-1, are described and some typical results are presented. Results of the investigations presented here show the importance of treating incoherency and uncertainty effects in analyzing severe LMFBR accidents. In contrast, the more benign accidents appear to be quite insensitive to incoherency effects. In addition, spectra of accident consequences are calculated by varying impact parameters within their range of uncertainty. This yields more detailed risk assessment information than single best-estimate and worst-case runs.

6747 (CONF-761001—P3, pp 1101-1110) **Pipe rupture studies for the CRBR using DEMO and SAS.** Hummel, H.H.; Kalimullah. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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It was found, in agreement with previous calculations, that the hot channel of the DEMO code model of the CRBR is well into the boiling range for a double-ended primary pipe rupture at the inlet nozzle, and boiling is just about attained for the peak channel. The situation improves rapidly as the break moves away from the inlet nozzle because inertial and static pressures maintain inlet plenum pressure long enough to permit stored pin heat to be removed. The most important hot channel factor in producing boiling conditions is the one applied to pin power, with factors affecting fuel-clad gap conductance and coolant flow contributing important but smaller effects. Calculations of maximum coolant temperatures with DEMO and with SAS using the same power and flow histories are in surprisingly close agreement considering the coarseness of the mesh in the DEMO pin heat transfer calculation.

6748 (CONF-761001—P3, pp 1111-1118) **Analysis of postulated FFTF pipe ruptures.** Markowski, F.J.; McCall, T.B.; Strawbridge, L.E. (Westinghouse Electric Corp., Madison, PA). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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A detailed assessment of the FFTF Primary Heat Transport System (PHTS) piping has led to the conclusion that the integrity of the piping is assured such that there is no realistic potential for a rupture. Nevertheless, consistent with the practice of showing design margins even for hypothetical events, a spectrum of postulated PHTS ruptures has been analyzed. The analyses showed that upstream of the reactor vessel inlet downcomer, rupture areas of any size including a double-ended rupture could be tolerated with no core coolant boiling. At the most limiting location, the reactor inlet nozzle, rupture areas of 75 in.^{2} and 55 in.^{2} could be tolerated for three-loop and two-loop operation, respectively. This paper will present the following: (1) the criterion with which consequences of postulated pipe ruptures are compared; (2) the general transient response of the FFTF to postulated ruptures; and (3) the acceptable rupture sizes for the FFTF primary loop for a variety of conditions.

6749 (CONF-761001—P3, pp 1121-1133) **Work-energy characterization for core-disruptive accidents.** Marchaterre, J. (Argonne National Lab., IL); Marciniak, T.; Bratis, J.; Fauske, H.; Jackson, J. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The key result sought after in the analysis of core-disruptive accidents (CDAs) in fast reactors, is the potential damage that a given accident can impart to the system. A primary source of damage is the expansion of vapor from materials that have been severely overheated by a prompt-critical excursion. As the high temperature vapors expand, they can do work on the structures that comprise the primary system of the reactor. Thus, the terms "work potential", and "work-energy" are often used to characterize damage potential. Current practice in analyzing damage in fast reactor systems is to develop a pressure-volume relationship for the expanding materials and then explicitly calculate the work done on various structural components in the primary system using a coupled hydrodynamics/structural response code. Although this provides a rather direct analysis of the damage, various techniques have been used to calculate the required pressure volume relationships. Further, it is not always practical to carry out such detailed analysis, and a variety of damage potential estimates have been, and continue to be used. This has often led to confusion as to what the actual damage potential for a given accident would be and how the various results reported in the literature are related to each other. The objective of this paper is to define the main techniques that have been used, and present a set of consistent calculations that compare the most important of these techniques for a range of reactor sizes and excursion severities.

6750 (CONF-761001—P3, pp 1152-1161) **Critical configurations and secondary excursions for high temperature fuel/steel mixtures.** Pena, J.; Froehlich, R.; Schmuck, P. (Kernforschungszentrum, Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The amount of fuel necessary for obtaining neutronically critical configurations is studied. Critical spheres of fuel or of fuel/steel mixtures embedded in sodium are considered and the necessary amount of fuel is determined as function of Pu-enrichment, void fraction, and steel content. It is found that rather large fuel masses are necessary, especially for high void fractions (low smeared densities) or relatively high steel content. The calculations have been done by applying transport and diffusion theory by using the 26 group KFK-INR cross section set. Secondary excursions are analysed for high temperature fuel masses by using a two partner model, where one mass is resting on depleted UO_2 and the other mass is falling on top of the first one. High and low density systems are studied. Free fall, fall in sodium, and in addition a rather slow fall are considered. For high density masses large reactivity ramps, high pressure pulses, but very low thermal energy releases are encountered. For low density systems relatively low reactivity ramps, relatively low pressures, but high thermal energy releases are obtained. The calculations have been performed by using the neutronic-hydrodynamics program KADIS and by starting from rather pessimistic assumptions. For the SNR-300 it can be concluded that secondary excursions in the external core retention device can be contained from a thermal and very likely also from a mechanical point of view if reasonable assumptions are made.

6751 (CONF-761001—P3, pp 1172-1182) **Role of wall heat transfer and other system variables on fuel compaction and recriticality.** Dhir, V.K.; Castle, J.N.; Catton, I.; Kastenberg, W.E.; Doshi, J.B. (Univ. of California, Los Angeles). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The assessment of the molten fuel gaining recriticality after a hypothetical core disruptive accident in a fast reactor is an important safety consideration. Recriticality of the disrupted core can be envisioned to occur, if the fuel rearranges itself into a denser configuration either due to gravity slumping of the molten fuel or due to pressure or heat transfer driven compaction of the earlier dispersed fuel. In this paper the role played by wall heat transfer, internal radiation and the bottle pressure on the physical state of the molten fuel pool is discussed. It is suggested that in the absence of a solid crust the heat transfer process from the molten fuel to the surrounding steel will be very efficient because of melting and buoyancy driven removal of less dense steel through the pool of heavier UO_2. The internal radiation at the high fuel temperature significantly increase the effective thermal conductivity of the molten fuel and lead to increased heat transfer in situations where a solid crust of UO_2 exists between molten UO_2 and molten steel. IN a boiled-up bottled pool, the pool pressure is shown to increase very rapidly with time and thus necessitate higher fission heating of the fuel to maintain it in a certain boiled up state. Finally, the results of the above discussion are applied to study the recriticality of a fuel pool formed during a hypothetical core disrupted accident in a fast reactor.

6752 (CONF-761001—P3, pp 1216-1224) **Large-scale deterministic computer code systems and LMFBR safety: a perspective.** Wider, H.U.; Bohl, W.R.; Dunn, F.E.; Ferguson, D.R. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The development and application of large-scale deterministic computer code systems in the LMFBR safety field involves a set of complex and many-faceted issues. This paper discusses a number of these issues. Motivations cited for developing these code systems are the desire to predict more realistic accident sequences and the need to isolate and identify key phenomena which require further experimental and analytical investigation. Code development difficulties which are discussed include those arising from the limited capabilities of current computer systems, the sometimes limited understanding of relevant phenomena and the need to provide some experimental verification of code models. The interaction required among code developers, experimentalists and phenomenological modelers is explored. In addition, the roles that such safety code systems can play in LMFBR design and in the actual licensing process are discussed.

6753 (CONF-761001—P3, pp 1225-1235) **SAS4A LMFBR accident analysis code system: a progress report.** Ferguson, D.R.; Bohl, W.R.; Bowers, C.H.; Cahalan, J.E.; Dunn, F.E.; Heames, T.J.; Kyser, J.M.; Wang, W.L.; Wider, H.U. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The SAS4A LMFBR accident analysis code system, which is currently under development at Argonne National Laboratory as the successor to the SAS3A code system, is discussed. Significant experience gained in the application of SAS3A to the study of hypothetical core disruptive accidents in a variety of LMFBR designs which has motivated the overall approach taken in SAS4A is cited. The structure and organization of SAS4A is presented, followed by a description of the new general code modules and phenomenological modules that are being developed for SAS4A.

6754 (CONF-761001—P3, pp 1244-1252) **Multi-field hydrodynamic disassembly calculations with space—time kinetics: FX2/VENUS-III.** Weber, D.P.; Ganapol, B.D. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The development of computer codes which analyze the hydrodynamics, neutronics, and thermodynamics of hypothetical LMFBR disassembly starting with the Lagrangian 2-D hydrodynamics code VENUS and extending to the Eulerian hydrodynamics code FX2/VENUS-III RM which includes treatment of multi-field motions as well as space-time kinetics are reviewed. The physical assumptions that form their basis are indicated and the differences in solution technique are illustrated. Primary emphasis is given to the description of the Eulerian code development with indications of the capabilities of implicit differencing, the necessity of tracking generic fuel types, the effect of relative motion, and the role of space-time kinetics. Several examples and comparisons of codes are given for FTR and 1000 MW(e) designs.

6755 (CONF-761001—P3, pp 1253-1260) **Core disruptive accident and recriticality analysis with FX2-POOL.** Abramson, P.B. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The current state of development of FX2-POOL, a two-dimensional hydrodynamic, thermodynamic and neutronic scoping model for Hypothetical Core Disruptive Accident analysis is described. Checkout comparisons to VENUS for prompt burst conditions were good. Use of FX2-POOL to examine the importance of fuel to steel heat transfer during a prompt burst indicates that heat transfer plays no important role on that time scale. Scoping studies of material thermohydrodynamics for about 20 to 30 milliseconds following the prompt burst indicate that heat transfer is important on the time scale necessary for the CDA bubble to grow to the size of the original core. Preliminary results are presented for energetics of boiling fuel steel pools which are forced recritical by local surface pressurization.

6756 (CONF-761001—P3, pp 1261-1268) **Eulerian finite element method for unsteady compressible flow problems.** Van Goethem, G. (Univ. of Louvain, Belgium). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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An Eulerian finite element method is presented for solving transient compressible flow problems. Quadrilateral elements with linear velocity fields and constant pressure and density are considered. The Galerkin procedure is used to formulate a variational statement associated with the momentum equation and its boundary conditions. In order to simplify the treatment of the transport terms appearing in the Eulerian conservation equations the calculational scheme is divided into two steps at each time interval. Intermediate values of the velocities are first determined by ignoring the transport effects. These velocities are then introduced into the transport terms to get the final values of the hydrodynamic quantities at the time under consideration. An explicit time integration technique is used in connection with a lumped mass matrix. Good agreement with analytical results is obtained in the shock tube problem described here.

6757 (CONF-761001—P3, pp 1269-1279) **Probabilistic/deterministic procedure for analyzing LMFBR core disruptive accidents.** Vaurio, J.K.; Mueller, C. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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A general procedure is presented for obtaining the probability distributions of selected consequences of an LMFBR hypothetical core disruptive accident. The uncertainties of the consequences are considered as a variability of the system and model input parameters used in the accident analysis. Probability distributions are assigned to these input parameters and parameter values are systematically chosen from these distributions. These input are then used in deterministic consequence analyses which are performed by fast-running analogues of the comprehensive mechanistic accident analysis codes. The results of these deterministic consequence analysis are used to generate the coefficients for multivariate polynomials which approximate the consequences in terms of the selected input parameters. These approximating polynomials are then used to generate the probability distributions of the consequences with random sampling being used to obtain the accident parameters from their distributions. The use of the procedure is illustrated by an application to a postulated loss of flow transient with failure to scram in the CRBR.

6758 (CONF-761001—P3, pp 1285-1294) **Generalized Eulerian method in reactor containment analysis and its comparison with other numerical methods.** Chu, H.Y.; Wang, C.Y.; Gvildys, J.; Chang, Y.W. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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The implicit continuous-fluid Eulerian method has been extended to include the treatment of the irregular cell which contains a moving wall boundary and the treatment of the special cell which has an out-flow boundary condition where the opening of the out-flow boundary is smaller than the side of the Eulerian cell. The extended method has been applied to a number of problems of interest in fast reactor containment analysis. Numerical results of sample calculations are presented. Comparisons with other numerical solutions and experimental measurements are also given.

6759 (CONF-761001—P3, pp 1295-1303) **Evaluation of explicit finite-difference techniques for LMFBR safety analysis.** Bernstein, D.; Golden, R.D.; Gross, M.B.; Hofmann, R. (Science Applications, Inc., Oakland, CA). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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In the past few years, the use of explicit finite-difference (EFD) and finite-element computer programs for reactor safety calculations has steadily increased. One of the major areas of application has been for the analysis of hypothetical core disruptive accidents in liquid metal fast breeder reactors. Most of these EFD codes were derived to varying degrees from the same roots, but the codes are large and have progressed rapidly, so there may be substantial differences among them in spite of a common ancestry. When this fact is coupled with the complexity of HCDA calculations, it is not possible to assure that independent calculations of an HCDA will produce substantially the same results. Given the extreme importance of nuclear safety, it is essential to be sure that HCDA analyses are correct, and additional code validation is therefore desirable. A comparative evaluation of HCDA computational techniques is being performed under an ERDA-sponsored program called APRICOT (Analysis of PRImary COntainment Transients). The philosophy, calculations, and preliminary results from this program are described in this paper.

6760 (CONF-761001—P3, pp 1314-1323) **Simulation of hypothetical core disruptive accidents in vessel models.** Egleme, M. (Belgonucleaire, Brussels); Brahy, N.; Fabry, J.P.; Lamotte, H.; Stievenart, M.; Holtbecker, H.; Actis-Dato, P. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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Explosion experiments have been performed with a pyrotechnic compound in overstrong vessels, without internals or with a perforated plate, and in yielding vessels. Thanks to these tests the charge characteristics have been determined, the pressure-flow characteristics of a perforated plate attached to the roof have been established and the validity of the SURBOUM-II code has been checked for various geometries of yielding vessels.

6761 (CONF-761001—P3, pp 1324-1333) **Comparison of ANL containment codes with SNR-300 simulation experiments.** Marchertas, A.H.; Wang, C.Y.; Fistedis, S.H. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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A comparison of REXCO and ICECO code predictions is made with data obtained from experiments of LMFBR excursion models. The comparisons are based on published results of tests conducted for the safety analysis of the SNR-300 fast breeder. The test configurations consist of a centrally located spherical source immersed in a pool of water which is encased in a cylindrical container. The cylinical walls of the container are prestressed by holddown bolts which span the two rigid ends. The space above the surface of the water within the container is occupied by air. Although certain aspects of the tests could not be simulated by the analytical models exactly, the comparison of results shows quite close agreement. The fact that the REXCO and ICECO codes involve different analytical formulations, their own close correspondence of results lends added credence to the value of analytical predictions.

6762 (CONF-761001—P3, pp 1334-1343) **Safety analysis of the primary heat transport systems of LMFBRs.** A-Moneim, M.T.; Chang, Y.W. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

A two-dimensional Implicit Continuous-Fluid Eulerian Code designed for the safety analysis of the primary heat transport systems of LMFBRs is described. The code includes a separate model for all the components of the system, except the primary pump. These models are coupled together hydrodynamically to form a loop that can be subjected to two simultaneous pressure pulses. The structural response of the external walls of all the pipes and components is coupled with the hydrodynamics so that the fluid transients and the structural response of the system can be analyzed. Only the elbow walls are limited to be rigid.

6763 (CONF-761001—P3, pp 1344-1353) **Some aspects of the structural response of pool-type LMFBR systems to HCDA and seismic events.** Marciniak, T.J.; Seidensticker, R.W.; Kulak, R.F.; Kennedy, J.M.; Fistedis, S.H. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

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Of the geometries possible in configuring an LMFBR system, there are essentially two which have been given the greatest amount of study throughout the world. These are the loop system and the pool system. This study addresses the safety related questions of the pool-type system to response energetic HCDAs and seismic events. Using representative reactor configurations of commercial size LMFBRs, it is shown that it is possible to design pool-type systems to accommodate HCDA and seismic loads despite the fact that the primary tank is a large diameter, thin walled structure and that the shield deck could be vulnerable to such loads.

6764 (CONF-761001—P3, pp 1354-1362) **Mitigating effect of coolant cavitation in the response of LMFBR containment to a whole-core accident.** Jones, A.V. (Joint Research Centre, Ispra, Italy). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

The deformation and damage to LMFBR containment consequent upon a whole-core accident is the result of the transmission of energy in the form of pressure waves from core region to containment structures by the coolant. If a mechanism can be invoked which dissipates some fraction of the energy of these pressure waves within the coolant itself the cost and other benefits in designing and constructing a containment for a given whole-core accident are obvious. This paper presents evidence that cavitation in the coolant is such a mechanism, recounts the theoretical developments made in modelling coolant behaviour and estimates the effect of cavitation in reducing loads to containment both in model experiments using water and in the real reactor. Plans for further theoretical and experimental investigations are also discussed.

6765 (CONF-761001—P3, pp 1365-1375) **Fuel-clad stress—strain state at the beginning of a transient.** Sun, Y.H.; Okrent, D. (Univ. of California, Los Angeles). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

This paper deals with KRASS (Kwick-Running Analysis for Stress and Strain), a simplified, fast-running, axi-symmetric computer code intended to predict fuel element conditions after long term steady state operation in an LMFBR. KRASS assumes restructuring has already occurred and divides the fuel pellet into two zones, an inner, highly plastic, hot region and an outer, cooler region which, together with the cladding, can undergo creep. The code allows for fission gas pressure, fuel swelling, and hot pressing with simple models, and it includes alternative correlations for stainless steel swelling. Fuel cracking is not included. The output of KRASS includes the radial and axial distribution of stress and strain on fuel and clad as a function of burnup. KRASS takes eleven hundred machine unit seconds on the UCLA IBM-360-91 to calculate fuel element behavior to 15 percent burnup with seven axial sections in the fuel column. The results indicate that the axial variation of fuel-clad mechanical interaction depends strongly on the fluence-to-burnup ratio, as well as the applicable stainless steel swelling correlation, and that transient fuel element behavior studies of pre-irradiated fuel need to allow for such differences. The position of maximum fuel-clad mechanical interaction frequently is found to occur in the lower third of the fuel element during steady state irradiation; at high fluence-to-burnup ratios the central axial nodes generally exhibit gap-reopening tendencies.

6766 (CONF-761001—P3, pp 1376-1384) **Prediction of high strain-rate deformation of LMFBR cladding during reactor transients.** Chow, L.S.H.; Shack, W.J. (Argonne National Lab., IL). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

A time-independent plasticity model is proposed. The model is incorporated into the LIFE code to predict the high strain-rate cladding deformation. A benchmark problem was solved using the modified code. The results are in good agreement with an analytical solution and a finite-element solution for the same problem. The modified code is also used to predict cladding deformation in simulated over-power transient experiments. In this case, adequate agreement can only be obtained using a strain-rate-dependent yield stress.

6767 (CONF-761001—P3, pp 1385-1392) **Response of single subassembly hexcan wrappers to pressure loads.** Ash, J.E. (Argonne National Lab., IL); Marciniak, T.J.; Romander, C.M.; Cagliostro, D.J. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

The Liquid Metal Fast Breeder Reactor (LMFBR) core structure consists of a matrix of hexagonal subassembly ducts. Evaluation of the safety aspects of the core structure requires that reliable computational procedures be available to predict the deformation response of the subassembly configuration to postulated local energy releases. Finite-element computer codes have been developed to calculate deflections and strains of a hexcan subassembly wrapper subjected to internal and external dynamic pressure loadings. A series of experiments on simple out-of-pile hexcan sections has been performed to validate the computer codes. Particular attention has been directed towards the determination of the influence of the mechanical properties of the steel upon the hexcan response.

6768 (CONF-761001—P3, pp 1399-1408) **Analytic studies of subassembly failure propagation.** Belytschko, T. (Univ. of Illinois, Chicago); Kennedy, J.M. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

The prediction of subassembly response to energy sources and failure propagation is a three dimensional problem involving a fluid coupled with a structure. Because of the large expense involved in solving such three dimensional problems, a simplified, quasi-three dimensional treatment, in which the axial flow within the subassembly is treated by a one dimensional model coupled to a two dimensional model which represents the behavior in the cross section of the energy source has been developed in STRAW. For purposes of studying the validity and limitations of this model, a more complex computational approach which retains more of the three dimensional character was used and compared to STRAW predictions. It is shown that the results obtained by the quasi-three dimensional model are on the whole satisfactory; its predictions differ from the three dimensional solutions by about 10 percent or less in most cases.

6769 (CONF-761001—P3, pp 1409-1418) **Stress intensity factors for corner-cracked subassembly ducts.** Petroski, H.J. (Argonne National Lab., IL); Achenbach, J.D. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

Plane strain stress intensity factors for cracks along the inside corners of internally pressurized hexagonal subassembly ducts have been calculated by various methods and compared.

6770 (CONF-761001—P3, pp 1419-1426) **Explosion tests on LMFBR-core models; an evaluation for reactor safety.** Will, H. (Institut fuer Reaktorentwicklung Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

With regard to a certain, serious, unprobable reactor fault, explosion tests on core models for the SNR 300 are being carried out. The aim of the experiments is, to prove, that the deformation resulting from such a fault does not influence the reactor to be shut down. Until now, the six experiments that have been done show, that even in the case of conservative essentials with respect to the pressure loading of the postulated local fault, no power excursion can be expected. The deformations remain in the row of subassemblies next to the incident wrapper. The main experimental results are presented.

6771 (CONF-761001—P3, pp 1427-1435) **Finite element solution of transient fluid-structure problems in Lagrangian coordinates.** Donea, J.; Fasoli-Stella, P.; Giuliani, S. (EURATOM, Ispra, Italy). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. III.

A finite element method of analysis is described for the transient dynamic response of fluid-structure configurations. Hydrodynamic elements with linear and quadratic local velocity fields are considered. The structural elements are treated by a corotational formulation which accounts for large-displacement effects and nonlinear material behaviour. A lumped-explicit scheme is used for time integration of the equations of motion. Representative results are given for a Lagrangian frame of reference.

6772 (CONF-761001—P4) **Fast reactor safety and related physics. Volume IV. Phenomenology.** (American Nuclear Society, Chicago, Ill.; European Nuclear Society, Petit-Lancy (Switzerland)). 1976. Contract W-31-109-ENG-38. 705p. Dep. NTIS, PC A99/MF A01.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

Separate abstracts are included for 58 papers concerning single-phase flow and sodium boiling; sodium boiling and subassembly flow blockages; transient-overpower and loss-of-flow experiments; fuel and cladding behavior and relocation; fuel and cladding freezing; molten-fuel-coolant interaction; aerosols and fission product release, and post-accident heat removal. Thirteen papers have been perivously abstracted and included in ERA.

6773 (CONF-761001—P4, pp 1439-1447) **Multichannel analysis for predicting temperatures and boiling initiation in LMFBR subassemblies during a flow transient.** Nijsing, R.; Eifler, W. (EURATOM, Ispra, Italy). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

The transient thermo-hydraulic subchannel behaviour of LMFBR subassemblies subjected to loss-of-coolant-flow conditions, is analyzed. The temperature behaviour in the stage prior to boiling inception is described. The model applied is based on the description of a significant number of subchannels and associated fuel rods and takes account of transverse mixing between adjacent subchannels. An analytical approach is used for solving the energy equations pertaining to both the coolant and the solid material region. Illustrative results are given for various rod bundle configuration subjected to a prescribed flow decay.

6774 (CONF-761001—P4, pp 1457-1466) **Integral boiling phenomena under radial temperature gradients in a twelve rod bundle of LMFBR geometry.** Boswinkel, H.H.; Maarleveld, J.R.C.; Turkcan, E. (Netherlands Energy Research Foundation ECN, Petten). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

Steady boiling patterns obtained from a partly heated twelve rod bundle are discussed. A comparison with existing boiling models gives preference to the two-phase flow patterns which are usually applied in calculations for water cooled reactors. An attempt is made to apply the results obtained to the core of a fast breeder reactor under loss of flow conditions.

6775 (CONF-761001—P4, pp 1467-1476) **Numerical simulation of the two-dimensional boiling (voiding) in LMFBR subassemblies.** Miao, C.; Theofanous, T.G. (Purdue Univ., Lafayette, IN). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

Preliminary estimates of the two-dimensional voiding effects indicate that they are not likely to be very significant in affecting the time to flow reversal.

6776 (CONF-761001—P4, pp 1477-1487) **An investigation of forced convection boiling of sodium at low heat fluxes in electrically heated seven pin bundles.** Eisenhawer, S.W.; Albrecht, R.W. (Univ. of Washington, Seattle). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

Sodium boiling at low flow and heat fluxes can be expected in a gamma-heated, in-reactor experiment. The results of experiments under these conditions (10-40 W/cm^2, 10-50 gm/s) in electrically heated seven pin rod bundles are described. The type of boiling is seen to depend upon the amount of superheat, the degree of inlet throttling and several system dependent parameters. The possible forms of acoustic and neutronic signals from an in-core experiment are discussed in terms of the underlying thermalhydraulics and the experimental findings.

6777 (CONF-761001—P4, pp 1488-1493) **Transient sodium boiling characteristics at pump run down.** Kottowski, H.M.; Savatteri, C.; Mol, M. (Commission of the European Communities, Ispra, Italy). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

The transient pattern of boiling in simple channel geometry for loss of coolant conditions was investigated at various heat flux levels and mass flow rates. Heat flux densities of up to 900 W/cm were chosen for the individual experiments and were kept constant during the whole run-down until dry-out was reached. The rate of change of flow during the run-down was determined by the pump control circuit.

6778 (CONF-761001—P4, pp 1494-1501) **Steady state liquid metal boiling pressure drop characteristics.** Kottowski, H.M. (Commission of the European Communities, Ispra, Italy); Mol, M.; Savatteri, C.; Costa, J. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

Steady state Na-boiling experiments were performed in order to measure the boiling characteristics (pressure drop). These experiments were executed at various heat fluxes and mass flow rates up to dry-out. For the analysis of the experiments a steady state boiling computation code (ESSO) was developed. In a first approach a parametric study has been made using the various two-phase flow-models and friction multipliers proposed by Lockhart-Martinelli, Chen, Kalish and Peppler. A validation of the code with the experimental results was made.

6779 (CONF-761001—P4, pp 1502-1510) **Influence of the axial distribution of heat flux on sodium boiling in forced convection.** Meneghello, S.; Pezzilli, M.; Scarano, G. (Comitato Nazionale Energia Nucleare, Casaccia, Italy). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

The axial distribution of heat flux and single phase transient influence on incipient boiling superheat and sodium boiling dynamics have been studied by two test series in forced convection. These experiments were carried out in the same conditions of velocity, pressure, inlet temperature and mean heat flux on two wire wrapped single pin test-sections, geometrically similar, having respectively flat and sinusoidal (phi/sub max//phi/sub min/ = 1.7) axial distribution of heat flux. Moreover the influence of the bundle geometry on sodium boiling is carried out on the basis of the preliminary experiments on sodium boiling in seven pins bundle.

6780 (CONF-761001—P4, pp 1523-1531) **Sodium boiling experiments in a 19 pin bundle: two phase coolant dynamics.** Costa, J.; Menant, B. (Commissariat a l'Energie Atomique, Tunis). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

Permanent sodium boiling experiments have been performed in a 19 wire-wrapped pin bundle on the forced convection loop CFNa II of the Service des Transferts Thermiques at the Grenoble Nuclear Research Center. These experiments have shown that subcooled boiling, highly sensitive to the multidimensional aspects of bundles, is very noticeable : the singular coolant dynamics during subcooled boiling could lead to consequences such as burn-out and pin failure. Nevertheless, the behaviour of the sub-assembly during saturated boiling becomes grossly analogous to the bahaviour of a monodimensional channel, and the pressure drops which develop in the adiabatic parts of the subassembly may be of primordial influence on subsequent events.

6781 (CONF-761001—P4, pp 1532-1540) **Temperature distribution and local boiling behind a central blockage in a simulated FBR subassembly.** Brook, A.J.; Huber, F.; Peppler, W. (Gesellschaft fuer Kernforschung mbH., Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

A series of experiments has been carried out to investigate the effects of localised disturbance to the normal coolant flow in a fast reactor fuel element. The tests involved an electrically heated bundle of 169 pins, with a centrally located blockage extending over 49% of the flow area. Test section geometry corresponded to the SNR 300 Mk 1a fuel element. Measured temperature distributions behind the blockage agreed well with those measured in corresponding water experiments. The observed features of local boiling are discussed, and it is shown that a continued capability for cooling the blockage region is preserved, even with intensive local boiling.

6782 (CONF-761001—P4, pp 1541-1549) **Thermal-hydraulic correlations of a six-channel blockage in a sodium-cooled simulated LMFBR fuel assembly.** Han, J.T.; Fontana, M.H.; Wantland, J.L.; Gnadt, P.A.; Smith, C.M. (Oak Ridge National Lab., TN). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

The temperature measurements in the wake behind a six-channel internal blockage in a simulated CRBR fuel assembly have been studied and analyzed. The coolant residence time in the wake and the mass exchange rate between the wake and the adjacent free stream are calculated using a simple physical model. Correlations are obtained for the average coolant temperature rise in the wake, the maximum coolant temperature rise in the wake, the maximum (inner) cladding temperature and the mean Nusselt number in the wake with Reynolds numbers in the range of 10^4 less than or equal to Re less than or equal to 10^5 and the power per pin in the range of 16 to 33 kW/m. The results can be easily applied to predict the temperature rises in the wake behind a six-channel blockage located anywhere in the fuel assemblies of the CRBR and the FFTF, providing the blockage is located two rows or more away from the duct wall and has a negligible heat generation rate. Furthermore, it should be pointed out that no sodium boiling nor pin failure occurred in the tests and therefore, the reactor can still be operated safely under this kind of blockage condition.

6783 (CONF-761001—P4, pp 1560-1567) **Recent results of a local blockage experiment in a sodium cooled electrically heated bundle.** de Vries, J.E. (Netherlands Energy Research Foundation ECN, Petten); Hoebe, J.C.; Dorr, B. 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

The test section represents a 60-degree section of a SNR-300 fuel element having a 70% flat type central blockage. Experiments have been performed under single-phase and local boiling conditions. A parameter study of the wake temperatures has been carried out. It has been found that the normalized vortex temperatures depend on the Reynolds number. Apart from the temperature maximum in the vortex another relative temperature maximum has been found downstream the vortex. The boiling experiments showed that stable single-bubble boiling was dominating and the cooling capacity in the vortex enough to avoid dryout in this region.

6784 (CONF-761001—P4, pp 1568-1577) **Local boiling of sodium in downstream of local flow blockage in a simulated LMFBR fuel subassembly.** Kikuchi, Y.; Daigo, Y.; Ohtsubo, A. (Power Reactor and Nuclear Fuel Development Corp., Ibaraki, Japan). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

Local sodium boiling in the downstream of a six-subchannel blockage in an electrically heated LMFBR fuel subassembly mockup is described. The first series of experiments were conducted to measure temperature distributions in the downstream of the blockage under non-boiling conditions. The measured temperature rise due to the blockage agreed fairly well with the calculation by the LOCK code. When the experimental results are extrapolated to reactor conditions, the temperature rise due to the six-subchannel blockage is estimated to be less than 250°C. The second series of experiments were performed to investigate local boiling phenomena. In the local boiling region, no flow instability was observed since the subchannels near the wrapper wall were filled with subcooled liquid. In the nearly bulk boiling region, however, considerable upstream voiding occurred and then the inlet flow was reduced, leading to final dryout.

6785 (CONF-761001—P4, pp 1578-1586) **Decay heat removal from a pin bundle.** Kaiser, A.; Peppler, W.; Straka, M. (Gesellschaft fuer Kernforschung mbH., Karlsruhe, Ger.). 1976.

From International meeting on fast reactor safety and related physics; Chicago, Illinois, USA (5 Oct 1976).

In Fast reactor safety and related physics. Vol. IV.

A number of sodium experiments have been carried out using an electrically heated seven pin bundle to investigate steady-state heat dissipation capability of a LMFBR fuel element under complete inlet blockage conditions. Test have been performed in a 37 pin bundle to assess the amount of heat which can be removed under natural convection conditions in a system consisting of tests section, by-pass and cold leg. The results of several test runs are reported. The results of the complete inlet blockage tests are compared with those of a simple theoretical model. Because of the influence of the honeycomb grids, the capability for steady state heat dissipation is markedly reduced. Amounts of heat which can be transferred by boiling under natural convection conditions correspond broadly to reactor decay heat levels.

6786 (COO—2781-13) **Fuel Coolant Thermal Interaction Project UC 79P. Quarterly progress report No. 7.** (Massachusetts Inst. of Tech., Cambridge (USA)). Jul 1977. Contract EY-76-S-02-2781. 20p. Dep. NTIS, PC A02/MF A01.

The objective of the continued work on this project is to experimentally and analytically study the dominant mechanisms in fuel-coolant thermal interactions which could lead to vapor explosions. The exploration of mechanisms is focused in two areas: (1) investigations in dynamics of liquid-liquid film boiling; and (2) possible mechanisms of energy dissipation due to heat transfer during the HCDA expansion. Work being performed simultaneously in these areas is briefly described.

6787 (CREARE-TN—261) **Preliminary ramped transient analysis with superheated walls. Quarterly progress report, April 1, 1977—June 30, 1977.** Crowley, C.J.; Rothe, P.H.; Block, J.A. (Creare, Inc., Hanover, N.H. (USA)). Aug 1977. 33p. Dep. NTIS $4.00.

Recent results in a program to develop an analytical and empirical model for plenum filling in a 1/15-scale, cylindrical, elevated pressure PWR-model vessel are described. Work during the quarter included model-building experiments minimizing the effect of wall superheat in ramped transients and scoping the effects of high wall superheat and elevated ECC temperature on delivery delays with a steady steam supply. This report presents and discusses the findings in these areas. The topical section of this report outlines a preliminary analysis for ramped transients with superheated walls (including lower plenum heat transfer) based on time-marching application of steady-state correlations and equations. The preliminary analysis is compared with baseline ramped transient and steady steam supply data. The recent ramped transient data are shown to be consistent with earlier steady-state data. The directions of future work on the analysis are indicated.

6788 (EPRI-NP—408) **RETRAN: a program for one-dimensional transient thermal—hydraulic analysis of complex fluid flow systems. Volume I. Equations and numerics. Final report.** Moore, K.V.; Hughes, E.D.; McClure, J.A. (Energy, Inc., Idaho Falls, Idaho (USA)). Jan 1977. 380p. Dep. NTIS, PC A17/MF A01.

RETRAN represents a new computer code approach for analyzing the thermal-hydraulic response of Nuclear Steam Supply Systems (NSSS) to hypothetical Loss of Coolant Accidents (LOCA) and Operational Transients. In contrast to the "conservative" approach, RETRAN provides "best estimate" solutions to hypothetical

LOCA's and Operational Transients. RETRAN is a computer code package developed from the RELAP series of codes; from reference data, and from extensive analytical and experimental work previously conducted relative to the thermal-hydraulic behavior of light-water reactor systems subjected to postulated accidents and operational transient conditions. The RETRAN computer code is constructed in a semimodular and dynamic dimensioned form where additions to the code can be easily carried out as new and improved models are developed. The derivation of the general equations, the constitutive models and numerical solution schemes that form the bases of the RETRAN computer code are presented.

6789 (EPRI-NP—454) **RETRAN sensitivity studies of light water reactor transients. Final report.** Burrell, N.S.; Gose, G.C.; Harrison, J.F.; Sawtelle, G.R. (Energy, Inc., Idaho Falls, Idaho (USA)). Jun 1977. 228p. Dep. NTIS, PC A11/MF A01.

This report presents the results of sensitivity studies performed using the RETRAN/RELAP4 transient analysis code to identify critical parameters and models which influence light water reactor transient predictions. Various plant transients for both boiling water reactors and pressurized water reactors are examined. These studies represent the first detailed evaluation of the RETRAN/RELAP4 transient code capability in predicting a variety of plant transient responses. The wide range of transients analyzed in conjunction with the parameter and modeling studies performed identify several sensitive areas as well as areas requiring future study and model development.

6790 (IWGFR—5, pp 38-42) **Simulation of different transient clad failure mechanisms in fuel pin modelling.** Kuczera, B. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

For the analysis of hypothetical core disruptive accidents (HCDAs), failure time and failure position of a fuel pin and the state of the fuel itself are important parameters with respect to the initial conditions of the subsequent fuel coolant interaction (FCI). Various, time dependent load conditions may cause the cladding tube to fail. The main failure reasons are: (1) mechanical fuel-clad interaction due to differential expansion, (2) loading due to fission gas pressure, (3) local contact of molten fuel and clad, and (4) clad melting under dry-out conditions. The influence of threshold values (failure criteria) on simulated accident sequences is demonstrated.

6791 (IWGFR—5, pp 67-68) **MONJU fuel pin safety irradiation program in GETR.** Kawata, T.; Kikuchi, S.; Uematsu, K. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

Within the activities of experimental support of the MONJU safety design, a total of twenty fuel pin tests are planned to be performed in GETR. Of these twenty tests, nine are of the loss of coolant flow (LOC) type, and six are of the local flow blockage (LFB) type. These tests include the experiments on the fresh pins as well as on the fuel pins preirradiated in the fast flux conditions. French fast reactor Rapsodie will be used for the preirradiation of the fuel pins. Remaining five test are of the overpower (OP) type and include only fresh pins. This synopsis gives the outlines of these three types of experiments.

6792 (IWGFR—5, pp 87-91) **Effects of preconditioning of fuel rod failure during a transient overpower.** Croucher, D.W.; Harbourne, B.L.; Evans, S.K.; Stephen, J.D. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The structure of the fuel at the start of an overpower transient may affect the time and location of failure of an irradiated fuel rod. It is, therefore, important to determine first, the characteristics of the structure (whether it is relatively open or closed to movement of gas and molten fuel), and second, the mechanisms and magnitude of the effects. During steady power operation, the structure cannot be observed, and during shutdown and startup, the structure is changed by cracking. However, there is some evidence that the structure can become closed during normal operation (preconditioning). There is no data on the magnitude of any effects of a closed structure, since current transient tests start from shutdown (cracked) conditions. However, review of the probable failure mechanisms shows that the effects could be significant. It is concluded that the probability that a closed structure exists, added to the probable effect of a closed structure on failure, warrants a thorough evaluation of preconditioning.

6793 (IWGFR—5, pp 142-151) **Laboratory studies on melting and gas release behavior of irradiated fuel.** Weber, E.R.; Slagle, O.D.; Hinman, C.A. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The response of irradiated fuels to rapid heating is a major factor which must be considered in safety analyses for fast reactors. A series of experiments at HEDL provide observations and data on the response of fast flux (EBR-II) irradiated fuel materials when subjected to rapid heating in the laboratory. Fuel samples within a resistively heated tungsten tube are subjected to thermal transients in a system providing for temperature and pressure measurements, in addition to continuous gamma radiography of the sample. Results of heating fuel at rates of 50° to 250°C/sec. are presented. Unirradiated UO_2 slumps rapidly when melted. Lower power irradiated fuel with uniform fission gas distribution was observed to break apart below the melting point, resulting in dispersal from the effect of released fission gas. Extensive gas bubble formation occurs below the solidus and bubble expansion results in a foam-like structure at the melting temperature. High power irradiated fuel behaves differently, consistent with the relative gas distribution and content. Less fuel motion is observed; the major effect of fission gas is to slow downward displacement upon melting. Measurements of the temperature dependence of gas release indicate that gas release begins at fuel temperatures near 2000°C and a significant fraction of the fission gas has been released when fuel reaches the melting temperature.

6794 (IWGFR—5, pp 174-189) **In-reactor safety tests with fuels for fast neutron reactors.** Bailly, J.; Kessler, G.; Teague, N.J. 1975.

From International working group on fuel failure mechanisms; Seattle, Washington, USA (11 May 1975).

In International working group on fast reactors.

The CEA has realized, alone and in collaboration with various foreign organizations, tests in in-pile loops for supporting the safety analyses of fast reactors. The first part of the SCARABEE program dedicated to cooling accidents was completed in 1974 at CEN-Cadarache. The main results obtained and the efforts in progress to interpret them are described.

6795 (LA-NUREG—6934-PR) **Nuclear reactor safety. Quarterly progress report, April 1—June 30, 1977.** Jackson, J.F.; Stevenson, M.G. (comps.). (Los Alamos Scientific Lab., N.Mex. (USA)). Aug 1977. Contract W-7405-ENG-36. 103p. Dep. NTIS, PC A06/MF A01.

Reactor safety studies involving HTGR, LWR, LMFBR, and GCFR type reactors are summarized.

6796 (LA-NUREG—6954-MS) **POST: a postprocessor computer code for producing three-dimensional movies of two-phase flow in a reactor vessel.** Taggart, K.A.; Liles, D.R. (Los Alamos Scientific Lab., N.Mex. (USA)). Aug 1977. Contract W-7405-ENG-36. 77p. Dep. NTIS, PC A05/MF A01.

The development of the TRAC computer code for analysis of LOCAs in light-water reactors involves the use of a three-dimensional (r-theta-z), two-fluid hydrodynamics model to describe the two-phase flow of steam and water through the reactor vessel. One of the major problems involved in interpreting results from this code is the presentation of three-dimensional flow patterns. The purpose of the report is to present a partial solution to this data display problem. A first version of a code which produces three-dimensional movies of flow in the reactor vessel has been written and debugged. This code (POST) is used as a postprocessor in conjunction with a stand alone three-dimensional two-phase hydrodynamics code (CYLTF) which is a test bed for the three-dimensional algorithms to be used in TRAC.

6797 (NEDO—12663) **GETR multi-channel core model for simulating internal natural circulation.** Yahalom, R. (General Electric Co., Pleasanton, Calif. (USA). Vallecitos Nuclear Center). Jun 1977. 92p. Electric Co., Pleasanton, CA.

A computer model (CORFLO) of a four-parallel-region core to analyze internal natural circulations and low flow events is described. The model is a quasi-steady state, includes top and bottom common plenums, and calculates the region flows and the fluid temperature distribution in the core. Detailed analyses of accident events (major pipe and nozzle breaks) in the General Electric Test Reactor are presented. Simulation of flow reversal cases, such as the loss of electrical power with either one or two emergency cooling valves open, is discussed. A description of a single-channel model (HOTCHAN) is presented. The model is used to determine peak temperatures and to analyze the flow in the channel with the highest power. Pump shaft seizure and pump rotor breakage events have been also simulated by the program. Because of its limitation in analyzing fast transients, the model greatly overpredicts flow temperature (or enthalpy) excursions.

6798 (ORNL/NUREG/TM—138) **High-temperature gas-cooled reactor safety studies for the Division of Reactor Safety Research. Quarterly progress report, April 1—June 30, 1977.** Ball, S.J.; Cleveland, J.C.; Conklin, J.C.; Sanders, J.P. (Oak Ridge National Lab., Tenn. (USA)). 20 Sep 1977. Contract W-7405-ENG-26. 25p. Dep. NTIS, PC A02/MF A01.

HTGR safety studies concentrated on detailed investigations of postulated Fort St. Vrain rod-withdrawal accidents. General Atomic Company's TAP program for analysis of HTGR nuclear steam supply system performance transients was implemented on the local IBM 360 computers, and the results of sample problem runs appear to be in reasonable agreement with those published by General Atomic.

6799 (ORNL/NUREG/TM—139) **Quarterly progress report on fission product behavior in LWRs, April—June 1977.** Malinauskas, A.P. (Oak Ridge National Lab., Tenn. (USA)). Aug 1977. Contract W-7405-ENG-26. 29p. Dep. NTIS, PC A03/MF A01.

Two fission product release experiments were conducted in an air atmosphere. One of these, High Burnup Fuel Test 5, was conducted over a 20-hr period at 500°C. In this experiment, 0.5 x 10^{-6} percent of the total cesium inventory and 91 x 10^{-6} percent of the ruthenium inventory were released from the rod. The second test, High Burnup Fuel Test 6, was run over a 5-hr period at 700°C. The experiment yielded a cesium release amounting to 14.3 x 10 rcent of inventory, whereas the ruthenium release was 7.3 x 10^{-4} percent. The ruthenium releases are markedly greater than observed previously in corresponding tests in steam. Design of the fission product transport test facility has progressed to the point at which estimates of the costs of construction can be made.

6800 (ORNL/NUREG/TM—148) **Monthly highlights for Office of Nuclear Regulatory Research Programs at Oak Ridge National Laboratory, August 1977.** Fee, G.G. (comp.). (Oak Ridge National Lab., Tenn. (USA)). 13 Sep 1977. Contract W-7405-ENG-26. 30p. Dep. NTIS, PC A03/MF A01.

Technical highlights are presented for the following safety-related studies: heavy section steel technology, fission product beta and gamma energy release, fission product release from LWR fuel, fission product transport tests, multirod burst tests, Nuclear Safety Information Center, PWR blowdown heat transfer-separate effects, zircaloy fuel cladding collapse studies, zirconium metal-water oxidation kinetics, aerosol release and transport from LMFBR fuel, HTGR safety analysis and research, design criteria for piping and nozzles, and noise diagnostics for safety assessment.

6801 (SAND—76-0740) **Radiation signature folowing the hypothesized LOCA.** Bonzon, L.L. (Sandia Labs., Albuquerque, N.Mex. (USA)). Sep 1977. Contract EY-76-C-04-0789. 128p. (NUREG—76-6521). Dep. NTIS, PC A07/MF A01.

The study establishes the radiation source profile following the hypothesized Loss of Coolant Accident (LOCA) as suggested by the applicable Regulatory Guides. The source is specified as time-dependent gamma and beta energy release rates and energy spectra with dose and dose rate values presented for a generic containment structure. The results of the study will provide a basis for a comparison of radiation simulators used in (radiation) qualification testing of Class I components and an evaluation of simulator "adequacy" in duplicating the LOCA radiation environments and resultant component damage.

6802 (SAND—77-0611) **Fast Reactor Safety Research Program. Quarterly report, January—March 1977.** (Sandia Labs., Albuquerque, N.Mex. (USA)). Aug 1977. Contract EY-76-C-04-0789. 144p. (NUREG—0181-2). Dep. NTIS, PC A07/MF A01.

Progress is summarized in the following study areas: accident energetics; core debris behavior; sodium containment and structural integrity; research for elevated temperature design criteria; fuel motion detection; and ACPR fuel motion detection system.

6803 (SAND—77-1018C) **Fission-gas bubble modeling for LMFBR accidents.** Ostensen, R.W. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 10p. (CONF-771109—12). Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, California, USA (27 Nov 1977).

The behavior of fission-gas bubbles in unrestructured oxide fuel can have a dominant effect on the course of a core disruptive accident in an LMFBR. The paper describes a simplified model of bubble behavior and presents results of that model in analyzing the relevant physical assumptions and predicting gas behavior in molten fuel.

6804 (SAND—77-1094C) **Effective equation-of-state measurements on uranium dioxide.** Reil, K.O.; Cronenberg, A.W. (Sandia Labs., Albuquerque, N.Mex. (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1977. Contract EY-76-C-04-0789. 7p. (CONF-771109—4). Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, California, USA (27 Nov 1977).

The safety analysis of Liquid Metal Fast Breeder Reactor (LMFBR) systems requires knowledge of the vapor pressure of reactor fuels up to 6000 K. A new technique was developed to obtain experimental vapor pressure data for reactor fuel materials at high temperatures and pressures. Fuel samples are pulse fission heated in the Annular Core Pulse Reactor (ACPR) at heating rates comparable to those anticipated during a severe LMFBR transient. Since the vapor of reactor fuels may contain several dissociated fuel species, volatile fission products, and/or fission gas, and the evolution of that pressure may be time or rate dependent, the terminology "effective equation-of-state (EEOS) measurement" was used to differentiate these results from the vapor pressure of pure materials. This technique can be easily applied to plutonium bearing and previously irradiated fuels. The EEOS technique was used to determine the vapor pressure of high purity uranium dioxide with an oxygen-to-metal ratio of 2.08. Energy depositions of up to 2720 J/g relative to room temperature were obtained, resulting in measured pressures in excess of 38 mpa.

6805 (SAND—77-1117C) **Large scale test technology.** Philbin, J.S.; Pickard, P.S.; Walker, J.V.; Young, M.F.; Odom, J.P. (Sandia Labs., Albuquerque, N.Mex. (USA); Science Applications, Inc., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 4p. (CONF-771109—6). Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, California, USA (27 Nov 1977).

The paper presents an overview of conceptual designs of facilities suitable for performing large scale LMFBR reactor safety tests. The versatility offered by the approaches discussed is intended to satisfy many of the requirements for establishing a pertinent experimental data base for core disruptive accident parameters.

6806 (TID—22797) **LOFT integral test system final safety analysis report. Revision I.** (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1977. Contract EY-76-C-07-1570. 697p. Dep. NTIS, PC A99/MF A01.

Safety-related information on the LOFT facility is presented under the following headings; operations, safety analysis of reactor operation, and quality assurance.

6807 (TREE-NUREG—1126) **Experiment data report for semiscale Mod-1 test S-06-6 (LOFT counterpart test).** Esparza, V.; Sackett, K.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1977. Contract EY-76-C-07-1570. 285p. Dep. NTIS, PC A13/MF A01.

Recorded test data are presented for Test S-06-6 of the Semiscale Mod-1 LOFT counterpart test series. These tests are among several Semiscale Mod-1 experiments conducted to investigate the thermal and hydraulic phenomena accompanying a hypothesized loss-of-coolant accident in a pressurized water reactor (PWR) system. Test S-06-6 was conducted from initial conditions of 15 792 kPa and 563 K to investigate the response of the Semiscale Mod-1 system to a depressurization and reflood transient following a simulated double-ended offset shear of the broken loop cold leg piping. During the test, cooling water was injected into the cold leg of the intact loop to simulate emergency core coolant injection in a PWR. The heater rods in the electrically heated core were operated at an axial peak power density which was 75% of the maximum peak power density (52.5 kW/m). Test S-06-6 also evaluated the effect of special hardware assumptions on the core response.

6808 (TREE-NUREG—1147) **Quarterly technical progress report on water reactor safety programs sponsored by the Nuclear Regulatory Commission's Division of Reactor Safety Research, April—June 1977.** (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1977. Contract EY-76-C-07-1570. 92p. Dep. NTIS, PC A05/MF A01.

Results from the previously conducted Semiscale Mod-1 ECC injection test series were analyzed. Testing in the LOFT counterpart test series was essentially completed, and the steam generator tube rupture test series was begun. Two tests in the alternate ECC injection test series were conducted which included injection of emergency core coolant into the upper plenum through use of the low pressure injection system. The Loss-of-Fluid Test Program successfully completed nonnuclear Loss-of-Coolant Experiment L1-4. A nuclear test, GC 2-3, in the Power Burst Facility Reactor was performed to evaluate the power oscillation method of determining gap conductance and to determine the effects of initial gap size, fill gas composition, and fuel density on the thermal performance of a light water reactor fuel rod. Additional test results were obtained relative to the behavior of irradiated fuel rods during a fast power increase and during a high power film boiling transient. Fuel model development and verification activities continued for the steady state and transient Fuel Rod Analysis Program, FRAP-S and FRAP-T. A computer code known as RELAP4/MOD7 is being developed to provide best-estimate modeling for reflood during a postulated loss-of-coolant accident (LOCA). A prediction of the fourth test in the boiling water reactor (BWR) Blowdown/Emergency Core Cooling Program was completed and an uncertainty analysis was completed of experimental steady state stable film boiling data for water flowing vertically upward in round tubes. A new multinational cooperative program to study the behavior of entrained liquid in the upper plenum and cross flow in the core during the reflood phase of a pressurized water reactor LOCA was defined.

6809 (XN-NF—77-25) **Exxon Nuclear Company ECCS evaluation of a 2-loop Westinghouse PWR with dry containment using the ENC WREM-II ECCS model. Large break example problem.** Krajicek, J.E. (Exxon Nuclear Co., Richland, Wash. (USA)). 30 Aug 1977. 54p. Nuclear Co., Inc., Richland, WA.

This document is presented as a demonstration of the ENC WREM-II ECCS model calculational procedure applied to a Westinghouse 2-loop PWR with a dry containment (R. E. Ginna plant, for example). The hypothesized Loss-of-Coolant Accident (LOCA) investigated was a split break with an area equal to twice the pipe cross-sectional area. The break was assumed to occur in one pump discharge pipe (DECLS break). The analyses involved calculations using the ENC WREM-II model. The following codes were used: RELAP4-EM/ENC26A for blowdown and hot channel analyses, RELAP4-EM FLOOD/ENC26A for core reflood analysis, CONTEMPT LT/22 modified for containment backpressure analysis, and TOODEE2/APR77 for heatup analysis.

6810 (K—76-124U(R)(Vol.1)) **Safety analysis of an HTGR plant including emergency shutdown. Volume 1. Final report.** Becar, N.J.; Wood, D.E.; Curtis, G.B. (Kaman Sciences Corp., Colorado Springs, Colo. (USA)). 30 Apr 1977. Contract EY-76-C-03-1148. 131p. Dep. NTIS, PC A07/MF A01.

This study was conducted to determine the probability that the Fort St. Vrain HTGR Plant can achieve and maintain safe shutdown and cooling for an extended period of time following a major incident that might require such action. The analysis of the plant and selected accident scenarios indicate that although there are many opportunities for individual component or subsystem failures in a plant this complex, the Fort St. Vrain Nuclear Power Plant has been designed with sufficient standby and component redundancy to anticipate these problems and allow continued safe operation while repairs are in progress. The probability of maintaining forced cooling over an extended period of time, assuming a mean fault detection and repair time of three days while using the Steam Drive, is estimated to be about 0.994. If the backup Water Drive is taken into account, the predicted availability becomes greater than 0.9999. Review of control rod test data, supplied by GAC, enabled an empirical maximum likelihood estimate of individual and multiple control rod failure to be made. The value obtained is compatible with values used in past analyses.

6811 **German Light-Water-Reactor Safety-Research Program.** Seipel, H.G.; Lummerzheim, D.; Rittig, D. *Nucl. Saf.;* **18**: No. 6, 727-756(1977).

The Light-Water-Reactor Safety-Research Program, which is part of the energy program of the Federal Republic of Germany, is presented in this article. The program, for which the Federal Minister of Research and Technology of the Federal Republic of Germany is responsible, is subdivided into the following four main problem areas, which in turn are subdivided into projects: (1) improvement of the operational safety and reliability of systems and components (projects: quality assurance, component safety); (2) analysis of the consequences of accidents (projects: emergency core cooling, containment, external impacts, pressure-vessel failure, core meltdown); (3) analysis of radiation exposure during operation, accident, and decommissioning (project: fission-product transport and radiation exposure); and (4) analysis of the risk created by the operation of nuclear power plants (project: risk and reliability). Various problems, which are included in the above-mentioned projects, are concurrently studied within the Heiss-Dampf Reaktor experiments.

6812 **Assessment of HTGR accident consequences.** Barsell, A.W.; Joksimovic, V.; Silady, F.A. *Nucl. Saf.;* **18**: No. 6, 761-773(1977).

Assessments were made of the consequences of the higher risk accident conditions postulated to occur in a reference 1975 General Atomic 3000-MW(t) high-temperature gas-cooled reactor. This probabilistic risk-assessment study, known as Accident Initiation and Progression Analysis, is funded by the Energy Research and Development Administration. The most representative accident conditions are (1) core heatup caused by a loss of off-site power or by a large earthquake, leading to a loss of forced circulation, (2) reheater tube failure, (3) depressurization of the primary coolant, and (4) steam-generator main bundle tube failure. The radiological consequences, which are based on representative U.S. population densities, were assessed in rems as a function of distance from the plant and man-rem exposures to the surrounding environment. The results indicate that the high-temperature gas-cooled reactor has excellent safety characteristics, which are inherent in the concept and are primarily associated with the choice of coolant and core design. Over a wide range of accident frequencies (from one accident per reactor-year to one accident in 10 million reactor-years), no accidents considered in the study are predicted to cause early or delayed fatalities or illnesses.

6813 **Technical note: a comparison of chi/Q estimates at the 5% probability level.** Smith, M.E.; Hollister, R.A. (Meteorological Services, Inc., Amityville, NY). *Nucl. Saf.;* **18**: No. 6, 820(1977).

Chi/Q values at the 5% probability level computed from a literal interpretation of NRC's suggested method were compared to a set of values computed from a more realistic approach. The NRC values were 6 to 20 times larger than those obtained from the method.

ENERGY STORAGE

MAGNETIC

6814 **Energy transfer from a superconducting magnet to an inductive load.** Onishi, T.; Miura, A. *Denki Shikensho Iho;* **41**: No. 2-3, 205-212(1977). (In Japanese).

Experiments on energy transfer between two superconducting magnets have been carried out using an inductive energy transfer system similar to the flying capacitor system developed at the Karlsruhe Institute. In the present system the capacitor is grounded and diodes are used instead of thyristors, and a fraction of stored energy is transferred to the capacitor only when the relay connected in parallel to the magnet is switched off. The capacitor is expected to have no constraint in size, while in the flying capacitor system the capacitor is required to exceed a threshold size. Consequently it is possible to shorten the transfer time to some extent in comparison with the one in the magnet with inductance of 1.2 h and a load of 0.41 h. The capacitance is 200 μf. It is possible to transfer 80.1% of the stored energy of 221 j into the lead in less than about 0.35 seconds.

COMPRESSED GAS

6815 (EPRI-EM—391) **Conceptual design for a pilot/demonstration compressed air storage facility employing a solution-mined salt cavern.** Vosburgh, K.G. (General Electric Co., Schenectady, N.Y. (USA). Power Systems Lab.). Jun 1977. 447p. Dep. NTIS, PC A19/MF A01.

A conceptual design for a compressed air energy storage (CAES) plant sited on the McIntosh salt dome in southwestern Alabama is presented. The plant has a peak turbine inlet pressure of 40 atm, with the peak air storage pressure ranging from 44 atm (constant pressure storage) to 86 atm (variable pressure storage). A weekly storage cycle is used, and power is generated at a rate of 800 MW for 2000 hours per year. The capital cost of these plants ranges from $196 to 200/kW (mid 1976). The fuel heat rate ranges from 4140 to 4330 Btu/kWh (LHV). Depending on the storage reservoir design, the system delivers between 1.15 and 1.39 kWh for each 1.00 kWh of charging energy. A modification of these designs was developed for 500 hours annual duty (peaking application). It would require a capital investment of about $140/kW, with the same heat rates and charging energy ratios as the 2000-hour designs. At the conceptual level of these designs, no technical or environmental barriers to constructing these plants were found. An evaluation was made of the operating economics of the designs of a new method for computing the efficiency of compressed air storage plants, and of experiments which might be performed at a demonstration plant.

PUMPED HYDRO

REFER ALSO TO CITATION(S) 7070

6816 **Storage of solar energy in the form of potential hydraulic energy.** Kettani, M.A. (Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia). pp 492-498 of In Heliotechnique and development. Volume I. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P1.

In areas where topography and solar energy income are compatible, solar energy could be used to pump water up to a higher level to be stored behind a dam. The stored water can then be used to produce hydroelectric energy in the conventional manner. The used water will then flow down to a reservoir at a lower level to be pumped up again in a closed cycle. For the system to be effective, losses of water by evaporation should be minimized, since water is acting here as a working fluid only. The feasibility of such a scheme is studied.

CAPACITOR BANKS

6817 Module for linear automatic charging of a capacitor device for storing two megajoules of electrical energy. Evstratov, G.I.; Plyashkevich, L.N. *Instrum. Exp. Tech. [USSR] [Engl. Transl.]*; **19**: No. 2, 426-428(Mar-Apr 1976).

The circuit of a module of a rectifying device is described which ensures an operating regime with automatic dc charging of a capacitor. The semiconductor system follows up the phase with which the thyristors are turned on as a function of the charging current the voltage across the capacitor bank, and likewise cuts out the voltage at the input of the rectifier in emergency situations. The charging of a storage unit having a capacitance 5.6*10$sup -2$ F to a voltage 5 kV is carried out in 3 to 5 min. The voltage across the storage device can be controlled in the 500-5500-V range for an instability of 2%. The 2-MJ capacitor bank is charged by five simultaneously operating rectifiers.

FLYWHEELS

REFER ALSO TO CITATION(S) 6821, 7071

6818 (SAND—0985C) **Design of spoked-rim composite flywheels.** Reedy, E.D. Jr.; Gerstle, F.P. Jr. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 12p. (CONF-771053—1). Dep. NTIS, PC A02/MF A01.

From Flywheel technology symposium; San Francisco, California, USA (5 Oct 1977).

Design and material choices which optimize the energy storage capacity of a free-spinning, circumferentially wound rim flywheel are identified. The rim designs considered were (1) a rim fabricated from a single material, (2) a rim with lead ballast uniformly distributed along its interior edge, and (3) a rim composed of two concentrically wound materials. The composite rims examined were reinforced with graphite, Kevlar 49, Kevlar 29, G-glass, and E-glass. The rims were required to satisfy weight, size and angular speed limitations which appear appropriate for a hybrid heat engine/flywheel propulsion system. A graphite/epoxy rim with an inner-to-outer-radius ratio of 0.775 was found to have the largest energy storage capacity.

6819 (UCRL—79503) **Bibliographic and numeric data bases for fiber composites and matrix materials.** McMurphy, F.E.; Quick, T.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Sep 1977. Contract W-7405-ENG-48. 9p. (CONF-771053—2). Dep. NTIS, PC A02/MF A01.

From Flywheel technology symposium; San Francisco, California, USA (5 Oct 1977).

Research leading to the creation of bibliographic and numeric data bases of material properties, under contract with ERDA's Division of Energy Storage Systems, (ERDA/STOR) is reported. Both bibliographic and numeric data bases for fiber composites and matrix materials, with particular emphasis to their application to modern flywheel technology have been created. The bibliographic data base was created to provide a direct means to visually examine pertinent literature. The numeric data base is being created to provide evaluated materials properties data for direct input to applications programs. These and related data bases are being prepared to serve ERDA/STOR administrators and their contractors in the expanding field of energy storage. Data bases and their evaluation programs will be stored on a PDP-11/70 computer system at LLL and be available for interactive use over the ARPAnet and by telephone dialup.

THERMAL

REFER ALSO TO CITATION(S) 6355

6820 (CONF-770943—1) **Applications of differential scanning calorimetry to the study of thermal energy storage.** Cantor, S. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 19p. Dep. NTIS, PC A02/MF A01.

From 7. Thermal Analysis Society conference; St. Louis, Missouri, USA (26 Sep 1977).

Differential scanning calorimetry (DSC) is a versatile tool for investigating the behavior of materials that store energy by melting or by undergoing solid-state transitions. Heating scans measure the enthalpy that can be stored and cooling scans yield the enthalpy that may be recovered from the material. Exotherms also provide information about supercooling. The automatic and rapid thermal cycling features of the instrument system can be used to greatly accelerate thermal decomposition that may arise from the daily duty cycle of the storage medium. These chemical reactions as well as those with containment or with substances added to improve performance can be detected from changes in the thermal spectra. In this study, DSC methods were applied to sodium sulfate decahydrate, paraffin wax, urea, and phthalimide. For $Na_2SO_4.10H_2O$, DSC measurements showed a decrease in heat of fusion with thermal cycling and, also, considerable supercooling; with added $Na_2B_4O_7.10H_2O$ (borax), supercooling was greatly lessened but not entirely eliminated. Paraffin wax did not supercool nor were there any indications that thermal cycling or contact with aluminum degraded its thermal performance. Urea, when thermally cycled, decreased in melting point and in heat of fusion; this compound also supercooled about 50° in DSC experiments. Phthalimide, $C_6H_4(CO)_2NH$, did not decompose when thermally cycled through its melting point, but it did exhibit marked supercooling. However, lesser supercooling of urea and phthalimide in test-tube scale experiments suggests that supercooling derived from DSC should be applied with caution. For phthalimide, the enthalpy of fusion, determined in this study, equalled 48.1 cal/g.

6821 (UCRL—80115) **Technological data bases for energy storage.** Quick, T.M . (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Sep 1977. Contract W-7405-ENG-48. 11p. (CONF-770955—1). Dep. NTIS, PC A02/MF A01.

From ERDA-information exchange meeting for thermal energy storage program; Gatlinburg, Tennessee, USA (29 Sep 1977).

The Data Management Group at the Lawrence Livermore Laboratory is conducting research leading to the creation of data bases for energy storage systems. These data bases are computer-based and will contain bibliographic information, material properties data, and data on essential criteria for energy storage systems. Access to these central files will be from remote terminals over computer networks and by telephone dial-up, in addition to the more conventional means of computer-generated reporting, and dissimination on magnetic tape. To validate the material properties data, a working agreement has been established between the Lawrence Livermore Laboratory (LLL) and the National Bureau of Standards (NBS). The Office of Standard Reference Data at NBS coordinates and monitors data evaluations by recognized data evaluation centers. One data request, for molten salts and molten salts systems (battery and thermal energy storage materials), has been completed and the data is being entered into a thermal energy storage (TES) and molten salts data bank. Other data requests for selected properties of metals and metal alloys (flywheel materials), composite materials (flywheel materials), solid electrolyte materials (battery materials), and metallic hydrides (hydrogen storage materials) are currently being worked by several data evaluation centers. A bibliographic data base for flywheel energy storage has been created and is currently in the process of publication. In addition, a comprehensive bibliography for molten salts and TES materials is in preparation. Preliminary computer printouts which demonstrate interactive aspects of the molten salts/TES material properties data base are part of this report.

BATTERIES

REFER ALSO TO CITATION(S) 6821

6822 (AD—768500/1) **Batteries.** (Defense Documentation Center, Alexandria, Va. (USA)). Oct 1973. 356p. (DDC-TAS—73-59). NTIS, PC A10/MF A01.

The bibliography is a selection of unclassified and unlimited citations on batteries. These references present information on design, cells, test, development, components, and performance characteristics. Discussed are many types of batteries, with most references relating to the nickel—cadmium batteries and organic batteries.

DESIGN AND DEVELOPMENT

REFER ALSO TO CITATION(S) 6841

6823 (ANL-K—77-3628-1) **Development of a lead acid battery suitable for electric vehicle propulsion. Final report.** Schlotter, W.J. (Eltra Corp., Plymouth Meeting, Pa. (USA). Electric Vehicle Group; Eltra Corp., Plymouth Meeting, Pa. (USA). C and D Batteries Div.; Eltra Corp., Plymouth Meeting, Pa. (USA). Prestolite Battery Div.). 26 Aug 1977. Contract W-31-109-ENG-38. 104p. Dep. NTIS, PC A06/MF A01.

This report contains two detailed designs, and the design rationale, for an improved state-of-the-art electric vehicle battery incorporating expanded metal grids. The nominal 96-volt and 20-kWh battery incorporating this improved design is expected to cost about 25% less when manufactured in a mature plant. This report also contains detailed estimates for the capital cost and operating cost of a pilot plant to produce electric vehicle battery plates incorporating expanded metal grids. It is expected that the first electric vehicle batteries incorporating expanded metal grids can be available fifteen months after approval of this program. An addition-

al program to improve lead acid batteries for electric vehicles further is also described. The advanced batteries resulting from this program are expected to incorporate either expanded metal grids and/or composite lead/plastic grids. In addition, these batteries are expected to contain low-density active materials. It is anticipated that those additional developments will result in an advanced battery capable of delivering 45 to 50 watt-hours/kg. As a result of the design and cost study, a "First Buy" improved state-of-the art vehicle battery proposed is included as part of this report. Eltra proposes to manufacture and deliver the required 2500 vehicle batteries within the time limits set forth by the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976. 20 figures, 13 tables.

6824 Rechargeable galvanic cell with zinc electrode and auxiliary structure. Benczur-Uermoessy, G.; von Benda, K.; Haschka, F. (to Deutsche Automobilgesellschaft mBh, Firma). US Patent 4,039,729. 2 Aug 1977. Priority date 9 May 1974, German, Federal Republic of (F.R. Germany). 14p.

A rechargeable galvanic cell has a housing containing at least one negative zinc electrode, at least one positive metal oxide or oxygen electrode, an alkaline electrolyte, at least one electrically conductive auxiliary structure exhibiting low hydrogen overvoltage for cathodic hydrogen evolution (which is not conductively connected with the electrodes), and at least one microporous separator for separating the auxiliary structure from at least one of the electrodes. The structure simultaneously acts as an auxiliary electrode to effect after discharging of the zinc electrode when connected to it, and as a dendrite barrier to prevent short-circuiting between the negative and positive electrodes during operation of the cell. This structure is arranged between one positive electrode and one negative electrode. 7 figures.

6825 (N—73-25095) **Mariner Mars 1971 battery design, test, and flight performance.** Bogner, R.S. (Cincinnati Univ., Ohio (USA)). 15 Apr 1973. 194p. (NASA-CR—132986; JPL-TM—33-591). NTIS, PC A09/MF A01.

The design, integration, fabrication, test results, and flight performance of the battery system for the Mariner Mars spacecraft launched in May 1971 are presented. The battery consists of 26 20-Ah hermetically sealed nickel—cadmium cells housed in a machined magnesium chassis. The battery package weighs 29.5 kg, and is unique in that the chassis also serves as part of the spacecraft structure. Active thermal control is accomplished by louvers mounted to the battery baseplate. Battery charge is accomplished by C/10 and C/30 constant current chargers. The switch from the high-rate to low-rate charge is automatic, based on terminal voltage. Additional control is possible by ground command or on-board computer. The performance data from the flight battery are compared with the data from various battery tests in the laboratory. Flight battery data were predictable on the basis of ground test data.

6826 (N—74-26516/6) **Battery system within the energy supply for Aeros battery system.** Winzer, G. (Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)). 1973. 27p. (In German). (DGLR-Paper—73-149). NTIS, PC A03/MF A01.

A battery system for the electric power supply of Aeros was developed. A silver—zinc battery with a minimum supply of 260 Wh was chosen for the start and acquisition phase. For the orbit phase a nickel—cadmium battery with a coulometer cell as a charge control element was selected. The technical specifications of the batteries are given and the mission results are discussed.

6827 Energy sources for electric cars. Port, F.J. (ESB Inc, Philadelphia, Pa). *Bull. Schweiz. Elektrotech. Ver.;* **68**: No. 3, 129-134(1977). (In German).

The development of batteries for electric vehicles is reported. Of 25 types of battery that were originally planned, only four have a chance of becoming operational and economical. These are an improved lead acid battery, the nickel-zinc and the zinc-chloride batteries, and as the sodium-sulfur battery, which can be considered as having the best chance for the future. Progress attained in their development is reported.

6828 Advanced battery design. Potter, D.E. *Electr. Eng. [Melbourne];* **52**: No. 4, 49-52(Apr 1975).

Developments in battery design for electric vehicles are reviewed. Advantages and disadvantages of various types are discussed. Battery types dealt with include the sodium/sulfur, the lithium/sulfur, the zinc/chloride, and the zinc/oxygen batteries.

6829 Problems of designing a sodium—sulfur storage battery: a promising power source for transport energy supply. Lidorenko, N.S.; Moiseev, V.I.; Muchnik, G.F.; Grudyanov, I.I.; Degtyarev, O.I.; Lanin, A.A. *Izv. Akad. Nauk SSSR, Energ. Transp.;* No. 4, 102-111(1975). (In Russian).

Characteristics of some promising electrochemical systems that could be used in storage batteries are briefly presented. The principles of operation of a sodium—sulfur accumulator are described, and problems that have to be solved before it can be successfully designed are considered. The present-day state of the art regarding the development of such a sodium—sulfur accumulator outside the USSR is set forth. Preliminary results of investigations of a sodium—sulfur reversible element utilizing a solid electrolyte based on sodium polyaluminate (β-alumina) are given.

PERFORMANCE AND TESTING

REFER ALSO TO CITATION(S) 6825

6830 Delco Remy freedom battery. Helms, J.L.; Coyner, J.H.; Hill, C.W. Warrendale, PA; Society of Automotive Engineers, Inc. (1977). 6p. (CONF-770205—80).

From Conference of the SAE International Automotive Engineering Congress and Exposition; Detroit, Michigan, United States of America (USA) (28 Feb 1977).

The Delco Remy Freedom Battery introduces an automotive battery that is independent of owner care. New materials, chemistry, and manufacturing processes used to produce a battery that is highly efficient and completely maintenance free are described. Characteristics of the battery permit installation in today's underhood environments, plus a new flexibility for remote mounting. Improved strength and lower weight eliminate many battery handling problems during assembly. In the aftermarket, acid filling and associated OSHA requirements are eliminated. Improved stand characteristics permit long shelf life without deterioration. Car owners are set free from concern with battery maintenance, provided plenty of cold weather starting power, and assured high resistance to heat and vibration damage. 11 figures.

6831 (N—73-19060) **Non-gassing nickel—cadmium battery electrodes and cells. Testing of 25-Ah cells. Supplementary report, 25 August 1972—25 November 1972.** Luksha, E.; Gordy, D.J. (Gould, Inc., Mendota Heights, Minn. (USA)). 23 Feb 1973. 23p. (NASA-CR—130932). NTIS, PC A02/MF A01.

The testing of 30 practical-size, experimental 25-ampere-hour cells constructed as part of an earlier negative-limited-cell development program is discussed. The test results showed that the negative-limited cell is a possible means of developing a long-lived secondary cell. The cells were tested for 500 cycles by using an accelerated regime approximating a 90-minute orbit period. Three groups of ten cells were tested at 0, 25, and 40 C. The cycle data showed that the negative-limited cells had higher degradation rates at the higher operating temperatures. At the conclusion of 500 cycles, the three groups had average capacities of 16.83, 12.74, and 5.71 ampere-hours for testing at 0, 25, and 40 C, respectively. The conditioning capacities of these cells was in the 25 ampere-hours range. The internal cell pressures of the three groups was also temperature dependent and was, in general, in the 2 psig range during the course of the test program. No periodic variation of the internal pressure with the state-of-charge was observed, except with some cells tested at 40 C.

6832 (N—73-20045) **OAO battery data analysis. Final report.** Gaston, S.; Wertheim, M.; Orourke, J. (Grumman Aerospace Corp., Bethpage, N.Y. (USA)). Feb 1973. 471p. (NASA-CR—131414). NTIS, PC A20.

Summary, consolidation, and analysis of specifications, manufacturing process and test controls, and performance results for OAO-2 and OAO-3 lot 20 Ah sealed nickel—cadmium cells and batteries are reported. Correlation of improvements in control requirements with performance is a key feature. Updates for a cell/battery computer model to improve performance prediction capability are included. Applicability of regression analysis computer techniques to relate process controls to performance is checked.

6833 (N—73-25096) **Mariner 9 power subsystem design and flight performance.** Josephs, R.H. (Cincinnati Univ., Ohio (USA)). 15 May 1973. 50p. (NASA-CR—132992; JPL-TM—33-616). NTIS, PC A03/MF A01.

The design and flight performance of the Mariner Mars 1971 power subsystem are presented. Mariner 9 was the first spacecraft to orbit another planet, and some of the power management techniques employed to support an orbital mission far from earth with marginal sunlight for its photovoltaic-battery power source are described. The performance of its nickel—cadmium battery during repetitive sun occultation phases of the mission and the results of unique tests in flight to assess the performance capability of its solar array are reported.

6834 (N—75-10583/3ST) **Evaluation program for secondary spacecraft cells: initial evaluation tests of General Electric Company 12.0 ampere-hour, nickel—cadmium spacecraft cells for the International Ultraviolet Explorer satellite.** Harkness, J.D. (Naval Ammunition Depot, Crane, Ind. (USA)). 1 Oct 1974. 29p. (NASA-CR—140672; WQEC/C—74-511). NTIS, PC A03/MF A01.

Evaluation tests are reported for 20 cells to be put into the life cycle program. Leak, capacity, internal resistance, internal short, and overcharge tests are described.

MATERIALS, COMPONENTS, AND AUXILIARIES

6835 (N—73-17040) **Evaluation of new plastic compression (Ziegler) type of seals for long-life planetary batteries.** Frank, H.A. (Jet Propulsion Lab., Pasadena, Calif. (USA)). 1 Feb 1973. 37p. (NASA-CR—130867; JPL-TM—33-588). NTIS, PC A03/MF A01.

A program was initiated to develop improved types of terminal seals for aerospace Ni—Cd batteries. The approach used did not involve attempts to improve the ceramic-to-metal seal that is now extensively employed for this application. Rather, the approach was directed toward the development and evaluation of new types of seals. Of prime interest in this initial investigation was the Ziegler type of compression seal and, in particular, the injection-molded version developed by the Bell Telephone Laboratories (BTL). A number of these units were designed, fabricated, and evaluated on an accelerated life test under a simulated battery environment. Results have shown that there are no major problems involved in scaling up the BTL small-size (5-amp) seal to a larger-size (up to 50-amp) seal suitable for most JPL flight batteries. Five out of five such seals successfully completed over 10 months of continuous thermal cycling without developing any leaks greater than 1.8×10^{-9} atm-cc-He/s.

6836 **Storage battery electrode tubes and method of filling.** Brinkmann, J.; Sucher, J. (to Varta Batterie Aktiengesellschaft). US Patent 4,039,730. 2 Aug 1977. Priority date 7 Mar 1975, German, Federal Republic of (F.R. Germany). 4p.

Tubular battery electrodes ae filled with a mix of lead oxide, sulfuric acid, and water to which electrolyte-resistant fibers have been added. These fibers strengthen the mass and reduce its tendency to escape through the pores of the tube envelope fabric. 17 claims.

6837 **Production of cadmium electrodes.** Pickett, D.F. (to Department of the Air Force). US Patent Application 375,239. 29 Jun 1973. 19p.

A cadmium electrode is prepared by positioning a porous nickel plaque between two cadmium sheets immersed in an aqueous solution of cadmium nitrate having a pH of 3 to 5 and maintained at a temperature of 95 to 110°C. After connecting the nickel plaque to the negative pole and the cadmium sheets to the positive pole of a power source, direct current is passed through the solution at 1.2 to 1.6 amperes per square inch of plaque for from 8 to 20 minutes; cadmium metal and cadmium hydroxide are thereby deposited inside the pores of the plaque. A cadmium electrode so prepared is especially useful as the negative electrode in nickel—cadmium batteries.

APPLICATIONS

REFER ALSO TO CITATION(S) 7063, 7065, 7067, 7068, 7069

6838 **Morris, C.** (Opportunities for battery-powered road vehicles). *Electr. Veh. [8]London[9];* **62**: No. 3, 14-15(Sep 1976).

Changing traffic and transportation systems will present an opportunity for a new kind of vehicle. It is the aim of this paper to identify the opportunities for battery-powered road vehicles which have now attained performance levels of a maximum speed of 40 to 50 mph (64 to 72 km/h), a traffic-compatible acceleration, a range in city traffic of 40 miles (64 km), and an adequate gradeability. The principal field of transport for such vehicles is that of programed vehicles which make the same routine trip day after day. This category is exemplified by vehicles for the delivery (and in some cases the collection) of small parcels, milk, bread, newspapers, laundry, and many more commodities and services. The range of this type can vary from 20 to 80 miles (32 to 130 km) daily. In the U.K. there are already more than 35,000 battery-powered vehicles in daily use for the door-to-door delivery of milk. The operators of these are entirely convinced of their reduced running costs (including significant reductions in maintenance), lower downtime, and minimal nuisance level compared with the equivalent internal combustion engine vehicle.

6839 **Three-firm partnership produced the Silent Karrier.** *Electr. Veh. [8]London[9];* **62**: No. 2, 10-11(Jun 1976).

The result of a partnership between Chloride Technical Ltd.'s Motive Power Projects Group, Chrysler United Kingdom, Ltd., and National Freight Corporation, a prototype battery-powered delivery van capable of speeds up to 40 mph and of carrying a 35-cwt. (3920-lb) payload has been on trial since February 1976 with a National Carriers, Ltd., depot in Birmingham. Silent Karrier, the new vehicle, was shown to the Press at a special launcing in Birmingham on 26 April. Silent Karrier is a development of the Dodge—Commer—Karrier range of Chrysler delivery vehicles, with a walk-through design that makes it ideal for battery power. Chloride designed the drive train for the Silent Karrier and is developing a new high-energy density battery which will greatly increase the vehicle's present operating range of about 40 miles in start—stop operation. The first vehicle is fitted at present with Chloride batteries of the lead—acid motive power type, 160 volts, 365 Ah/5 hr. These have a battery life of about four years, or between 1,000 and 1,200 operating days. The controller is the SCR electronic type with regenerative braking facility; power control is by constant pulse width, variable frequency followed by pulse widening at higher speeds.

6840 **Research and development of electric vehicles in Japan.** Itoh, K. *JEE [8]J. Electron. Eng.[9];* No. 113, 35-39(May 1976).

The advantages of electric vehicles are briefly noted. The status of electric vehicles under national research and development programs is discussed, including the main research emphasis which is laid on developing new types of batteries which have high energy density, reasonably long life, and high output. Also described are motors and control devices, application systems, and recharging methods.

6841 **Development of electric vehicles in Japan.** *Electr. Veh. [8]London[9];* **62**: No. 1, 18-23(Mar 1976).

In Japan, a plan instituted in February, 1971, and sponsored by the Science and Technology Agency of the Japanese Ministry of International Trade and Industry resulted in five types of experimental electric vehicles being built by February, 1973, together with such components as newly developed types of batteries. The vehicles constructed were a lightweight passenger car and a compact passenger car, one lightweight and one compact truck, and a 70-passenger electric bus. In an effort to minimize the weight of the vehicle bodies, research was also undertaken into new types of plastic materials. The target and actual performance specifications of the experimental cars and trucks are tabulated, as are detailed structural data on these vehicles, all of which used dc motors with SCR chopper control and lead—acid batteries. Seven types of battery for traction use were also developed (3 lead--acid, 2 zinc--air, one iron--air, one sodium--sulfur); data on these are also tabulated. Brief descriptions of features such as body construction, controls, and braking systems, not listed in the tables, are given in the text. Plans for further development are indicated.

6842 **Control of ac motors in a new concept of electric town car.** Byers, D.J.; Harman, R.T.C. (Univ. of Canterbury, New Zealand). *Electr. Eng. Trans., Inst. Eng., Aust.;* **EE 12**: No. 1, 35-38(1976).

The design philosophy behind the selection of a static inverter-powered ac induction motor drive for an electric vehicle is described, and a novel method of pulsewidth modulation using Walsh function multipliers is outlined. The conceptual design of a new electric town car, which ideally matches this type of drive and which is being developed at the University of Canterbury, New Zealand, is described. Regenerative braking is provided at the rear wheels, disk brakes are fitted to front wheels. Lightweight 12-volt traction batteries are being developed to fit a standard 209 mm x 165 mm x 241 mm polypropylene case. Twenty of these batteries will be connected in series, center-tapped to supply buses at +120 V and -120 V. Their specification calls for 10 to 12 kWh at the 3 hour rate, maximum current of 125A, and a life of 1000 cycles when discharged to 200 V and a mass of 300 kg.

6843 **Lucas assessing 100-mile range electric taxi.** *Electr. Veh. [8]London[9];* **61**: No. 4, 22-24(Dec 1975).

A prototype, front-wheel drive, battery-powered taxicab with a range of about 100 miles and a top speed of approximately 55 mph is being used by Lucas Industries as a traveling test bed for the evaluation of drive systems and other Lucas technology involved. The body was designed to minimize the overall dimensions and to keep down drag and weight to accomplish maximum utilization of the energy available from the lightweight Lucas lead—acid batteries. The cab meets the specification of the London Metropolitan Police Public Carriage Office. The 50 bhp 216-volt CAV motor which drives the taxi is located transversely at the front of the vehicle, level with the floor of the driving compartment. The motor drive is transmitted to the differential by low-loss double-reduction, Morse HY-VO chains giving a 5.63:1 drive ratio. The battery pack is carried in a detachable tray located under the vehicle floor. Although the pack can be charged in situ with appropriate equipment, it can also be readily exchanged for a new pack, if necessary. The process is said to take no longer than refueling a conventional vehicle. The Lucas developed control system is of the SCR chopper type.

ENERGY MANAGEMENT AND POLICY

REFER ALSO TO CITATION(S) 7798

6844 (ERHQ—0013) **Source Evaluation Board handbook. Procurement regulations handbook No. 1.** (Energy Research and Development Administration, Washington, D.C. (USA)). Jun 1977. 61p. Dep. NTIS, PC A04/MF A01.

This Handbook provides policies and procedures and guidance to source selection officials, source evaluation boards, and others who will participate in the preparation of requests for proposals, evaluation of proposals, preparation of source evaluation board reports, presentations to selection officials, and selection of offerors. The provisions of this Handbook shall be used in appropriate major procurements as provided for in ERDA-Directives and Procurement Regulations and for other situations as determined by the Administrator. Request for Proposals must, in the main, include a brief description of work or services to be furnished. (MCW)

6845 **Annual Review of Energy. Volume II.** Hollander, J.M.; Simmons, M.K.; Wod, D.O. (eds.). Palo Alto, CA; Annual Reviews Inc. (1977). 526p. .

Volume 1 of Annual Review of Energy (EAPA 2: 1928) provided a review of energy technologies and an examination of the policy issues surrounding energy production and use in one nation, the USA; the volume ended with an article on the international aspects of energy. This volume, Vol. 2, expands on that theme, providing analyses from a variety of perspectives on global, international, and national issues surrounding the production, trade, and use of energy. An abstract for each of the 18 individual reviews is included in Energy Abstracts for Policy Analysis (EAPA); 14 of the abstracts will appear in Energy Research Abstracts (ERA).

ENERGY ANALYSIS AND MODELING

REFER ALSO TO CITATION(S) 6857, 6858, 6859, 6860, 6866, 6867, 6868, 6872, 6873, 6917, 6928, 6932, 6938, 6942, 6957, 6960, 6965, 6971, 7044, 7439

6846 (BNL—23087) **Technical-economic modeling in energy planning.** Behling, D.J. Jr.; Cherniavsky, E.A.; Hoffman, K.C.; Jorgenson, D.W. (Brookhaven National Lab., Upton, N.Y. (USA); Harvard Univ., Cambridge, Mass. (USA)). 1977. Contract EY-76-C-02-0016. 28p. (CONF-771203—1). Dep. NTIS, PC A03/MF A01.

From Alternative energy sources symposium; Miami Beach, Florida, USA (5 Dec 1977).

A combined technological-economic model has been developed and applied to the assessment of alternative energy technologies and policies. The individual models that have been assembled are the Hudson-Jorgenson model of the economy and interindustry transactions, and the Brookhaven Energy System Optimization Model. Other data bases and fixed coefficient input/output models are employed as data sources and accounting frameworks to support this combined technological-economic model. The combined model has been used to develop long-range projections of energy-economic relationships and to perform cost benefit analyses of the U.S. energy R and D programs. The models assist in the comprehensive analysis of the interrelationships between technological change, the overall economy, and the environment as new resources and options such as conservation are implemented.

6847 (ERDA—77-61) **Energy analysis: handbook for combining process and input—output analysis.** Bullard, C.W.; Penner, P.S.; Pilati, D.A. (Illinois Univ., Urbana (USA). Center for Advanced Computation). Oct 1976. Contract EY-76-S-02-2865. 75p. Dep. NTIS, PC A04/MF A01.

Methods are presented for calculating the energy required, directly and indirectly, to produce all types of goods and services. Procedures for combining process analysis with input-output analysis are described. This enables the analyst to focus data acquisition effects cost-effectively, and to achieve a specified degree of accuracy in the results. The report presents sample calculations and provides the tables and charts needed to assess total energy requirements of any technology, including those for producing or conserving energy. An extensive bibliography is presented.

6848 (ORAU/IEA(R)—77-14) **Energy cost of energy: guidelines for net energy analysis of energy supply systems.** Perry, A.M.; Devine, W.D.; Reister, D.B. (Institute for Energy Analysis, Oak Ridge, Tenn. (USA)). Aug 1977. Contract EY-76-C-05-0033. 106p. Dep. NTIS, PC A06/MF A01.

Net energy analysis seeks to determine and interpret the energy expeditures required in order to supply energy to the producing and consuming sectors of the economy. To specify the problem, the following must be identified: what kinds of energy expenditures or resource commitments are to be included in the accounts; precisely what energy supply or conservation system is to be studied; and the industrial context, or production system, within which a particular energy supply system is to be evaluated. Net energy analysis comprises two major steps: qualitative identification and quantitative determination of all relevant energy flows for the system chosen for study and aggregate of these energy flows into appropriate indexes of system performance. These guidelines consider these issues and the procedures are outlined for use by ERDA and its contractors. (MCW)

6849 (PAE/3794—6) **Resource requirements, impacts, and potential constraints associated with various energy futures. Annual report.** Gallagher, J.M.; Barany, R.; Paskert, P.F.; Zimmerman, R.G.J. (Bechtel Corp., San Francisco, Calif. (USA)). Mar 1977. Contract EX-76-C-10-3794. 120p. Dep. NTIS, PC A06/MF A01.

This is the first annual report describing an effort by Bechtel Corporation to adapt and apply the Energy Supply Planning Model (ESPM) to the support of the systems analysis activities of the United States Energy Research and Development Administration. Office of the Assistant Administrator for Planning Analysis and Evaluation (ERDA/APAE). The primary emphasis of this program is the identification of resource requirements and the associated impacts and potential constraints associated with various future energy options for this country. Accomplishments in 1976 include model application and analysis of energy scenarios derived from the 1976 update of the ERDA National Plan and the "1976 National Energy Outlook" of the Federal Energy Administration; analysis of the availability of engineers, manual manpower, and selected materials and equipment commodities; addition of aluminum, carbon steel, and alloy steel materials requirements to the model data base; the addition of several kinds of energy facilities to the modeling system; and refinement of the various aspects of the model and data base. This program shows the need for a clear statement of national energy policy.

6850 **Global and international energy models: a survey.** Beaujean, J.M.; Charpentier, J.P.; Nakicenovic, N. (International Inst. for Applied Systems Analysis, Laxenburg, Austria). *Annu. Rev. Energy;* 2: 153-170(1977).

This paper surveys the important global and international energy models and provides summary information on the major research groups and organizations presently involved in energy modeling. In the first section an introduction is provided to the art and science of modeling and to the important concepts and methodologies used in formulating and implementing models. The second section surveys global models that include an explicit treatment of energy, and the next surveys international energy models. The fourth section summarizes the important research groups and organizations presently involved in the development and application of energy models, and the last section presents a survey and concluding remarks. The authors hope that this survey will facilitate communication between model developers and users, and will be useful both in stimulating research to improve models, and in stimulating the use of models for systematic analysis of the important energy issues facing the world. 36 references.

6851 **Energy, regional science and public policy.** Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976). 323p. (CONF-750554—).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

A separate abstract was prepared for each of the 16 papers included in this volume. Two papers were processed previously for the ERDA Energy Data Base.

6852 **Linear programming model for determining an optimal regional distribution of petroleum products.** Moore, C.L.; Zoltners, A.A. (Univ. of Massachusetts, Amherst). pp 119-135 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

Linear programming is examined as a potential model and analytical tool for planning and developing an efficient petroleum allocation strategy and for simulating the regional and national impact of specific distribution policies. Three types of uses are identified in the order of their social value and priority. Users are classified by region to identify the impacts on product demand and employment with changes in supply. Decisions (demand for petroleum) are the model output, which responds to five constraint categories. The model is found to offer planners and policy makers the flexibility to try several alternatives, requires standard practical data, and makes explicit assumptions about users' priorities. It is felt to give realistic information because it is based on actual employment and production. 10 references. (DCK)

6853 **Wisconsin Regional Energy Model: a dynamic approach to regional energy analysis.** Foell, W.K.; Mitchell, J.W.; Pappas, J.L. (Univ. of Wisconsin, Madison). pp 136-177 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

A multidisciplinary approach to the study of energy systems and policies, undertaken to improve the analytical tools needed to understand policy altnatives, resulted in a regional simulation model. The Wisconsin Regional Energy Model (WISE) is designed to consider technology and economics as well as all sectors of energy use. The information sought included the need for new energy facilities, feasible environmental tradeoffs, the role of conservation, and the effect of primary fuel diversions. An overview is given of the WISE structure and components. Applications include long-range forecasts of state energy demand and the impacts of changing consumption patterns. The model was used, for example, to analyze the effects of improved air conditioner efficiency, smaller passenger cars, and higher building insulation standards. The effects of natural gas diversion indicate a relatively easy shift to coal with power plants able to withstand up to a seven percent cut and the commercial and industrial sectors able, with energy conservation, to absorb a 10 percent diversion without serious disruptions. 16 figures, 4 tables, 17 references. (DCK)

6854 **Estimating the regional impacts of energy shortages.** Donnelly, W.; Parhizgari, A.M. (Federal Energy Administration, Washington, DC). pp 178-193 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

After reviewing several regional models for adaptability and theoretical validity, the Maryland Multiregional, Multi-Industry Forecasting Model was selected to estimate the effect of proposed natural gas curtailments on the Maryland economy. Two proposals, one recommended by the Federal Power Commission that ranks end-use priorities and the other a state plan for curtailing interruptible customers and spreading further reductions proportionately among all classes of customers, differ in the total amounts of gas the state would receive and the rate at which adjustment would be made. In spite of a lack of historical data, the regional model was found to be useful in forecasting the impacts of input shortages. The analysis indicates that, while some industry sectors and regions should be aggregated, energy sectors are more appropriately disaggregated. The extension of the model structure to include all land values rather than just agricultural land and backward linkages of output changes to their causes would make the forecasts more reliable. 5 tables, 16 references. (DCK)

6855 **Commodity modeling approaches to resources, energy, and regional planning.** Labys, W.C. (Univ. of Birmingham, England). pp 250-261 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

Methods of commodity modeling, which is felt to fill a need in analyzing problems of natural resources, energy, and regional planning are reviewed and evaluated. Market models are based on the micro-economic theory that market price is determined by the interrelationship of supply and demand. Modeling has recently incorporated factors of expectations, cycles, risk theory, and stability. Process models are based on the process of transforming a commodity to a product within a single industry where price is determined by costs of materials and production. A spatial equilibrium model integrates a linear programming model with the market model to permit profit maximization. Reactive programming includes a time dimension. Recursive programming uses a series of optimization problems with constraints where the final solution depends on earlier solutions. World trade models study the flows and adjustments of the commodity market. Applications of commodity modeling are appropriate to resource, energy and regional models. 1 table, 27 references. (DCK)

ECONOMICS AND SOCIOLOGY

REFER ALSO TO CITATION(S) 6853, 6854, 6855, 6870, 6872, 6874, 6880, 6882, 6900, 6935, 6939, 6943, 6954, 6958, 6971, 6978, 7027

6856 **Foreign economic trends and implications for the United States: United Arab Emirates.** *Foreign Econ. Trends;* **77-107**: 1-11(Aug 1977).

Prepared by American Embassy, Abu Dhabi.

The United Arab Emirates (UAE) economy in 1977 continued to expand rapidly. The 1977 Current Account balance of payments surplus should be about $5.5 billion and foreign exchange holdings should reflect another substantial increase. Oil revenue (up 19% in 1977) fuels the country's extensive infrastructural development and the beginnings of industrial development. Some high level concern, however, is expressed about the pace and purpose of expansion and its unintended social consequences. Good opportunities exist for the export of U.S. expertise and capital goods, although businessmen feel that recent tax legislation weakens the U.S. competitive position in the services field. UAE investment may well increase in the U.S., unless discouraged by exchange-rate changes or inflation.

6857 (NP—22465/1) **Utah process alternative futures, 1975—1990. Volume I: assumptions and projections.** Weaver, R.; Reeve, R.; Ellingwood, D.; Stowell, B.; Catlin, R.; Williams, A. (Utah Office of the State Planning Coordinator, Salt Lake City (USA)). Sep 1975. vp. TIC.

Volumes I and II contain the set of Alternative Future projections of economic and demographic conditions produced by the Utah State Planning Coordinator's Office for the State of Utah and its Multi-County Planning Districts (MCD). These volumes serve as a technical supplement to two summary reports, The Utah Process Alternative Futures, 1975-1990--Introduction and Summary and Report on the Extension of the Utah Process: A Procedure for Planning Coordination Through Forecasting and Evaluating Alternative State Futures. Volume I contains a narrative of the Alternative Futures and their implications, concluding with a sample Utah Process Economic and Demographic Impact Model (UPED) print out of Southeastern MCD (1975) in an appendix. (MCW)

6858 (NP—22465/2) **Utah Process alternative futures, 1975—1990. Volume II. Detailed projections.** Weaver, R.; Reeve, R.; Ellingwood, D.; Stowell, B.; Catlin, R.; Williams, A. (Utah Office of the State Planning Coordinator, Salt Lake City (USA)). Sep 1975. 419p. TIC.

Volumes I and II contain the set of alternative Future projections of economic and demographic conditions produced by the Utah State Planning Coordinator's office for the State of Utah and its Multi-County Planning Districts. These volumes serve as a technical supplement to two summary reports, The Utah Process Alternative Futures, 1975-1990—Introduction and Summary and Report on the Extension of the Utah Process: A Procedure for Planning Coordination Through Forecasting and Evaluating Alternative State Futures. Volume II includes age and sex specific population tables, school age population tables, occupied dwelling units tables, and broad sector employment tables, concluding with a sample UPED print out of Southeastern MCD (1975) in an appendix. (MCW)

6859 (NP—22465(Summ.)) **Utah Process alternative futures, 1975—1990. Introduction and summary.** (Utah Office of the State Planning Coordinator, Salt Lake City (USA)). Dec 1975. 42p. TIC.

The purpose of the Utah Process is to improve and coordinate the activities of all levels of government where there are substantial interdependencies. Particularly as it pertains to state government operation, the Utah Process comprises two separate though inter-related components. The first, the administrative cmponent, is concerned with institutionalizing a procedure for developing coordinated contingency plans and budgets by the various state governmental agencies. The second, the technical, component of the Utah Process is concerned with projecting and analyzing the impacts and implications of the Alternative Futures. The Alternative Futures projections reported upon in this Summary are produced through the use of the UPED Model. The model produces projections of levels and composition of future economic and demographic characteristics for the state and substate regions. Further, by comparing projections for different Alternative Futures, the model produces projections of the impacts of the various major developments of which the Futures are composed. (MCW)

6860 (ORNL/RUS—25) **MULTIREGION: a simulation-forecasting model of BEA economic area population and employment.** Olsen, R.J.; Westley, G.W.; Herzog, H.W. Jr.; Kerley, C.R.; Bjornstad, D.J.; Vogt, D.P.; Bray, L.G.; Grady, S.T.; Nakosteen, R.A. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. vp. Dep. NTIS, PC A15/MF A01.

This report documents the development of MULTIREGION, a computer model of regional and interregional socio-economic development. The MULTIREGION model interprets the economy of each BEA economic area as a labor market, measures all activity in terms of people as members of the population (labor supply) or as employees (labor demand), and simultaneously simulates or forecasts the demands and supplies of labor in all BEA economic areas at five-year intervals. In general the outputs of MULTIREGION are intended to resemble those of the Water Resource Council's OBERS projections and to be put to similar planning and analysis purposes. This report has been written at two levels to serve the needs of multiple audiences. The body of the report serves as a fairly nontechnical overview of the entire MULTIREGION project; a series of technical appendixes provide detailed descriptions of the background empirical studies of births, deaths, migration, labor force participation, natural resource employment, manufacturing employment location, and local service employment used to construct the model.

6861 **Economics and recycling.** Butlin, J.A. (Univ. of Manchester, Eng.). *Resour. Policy;* 3: No. 2, 87-95(Jun 1977).

The current state of recycling technology could appear to be a question of supply and demand, first for storage, disposal, and reclamation facilities, and secondly, for reclaimed materials. If supply and demand are to be relied upon as an environmental policy tool, several conditions need to exist within the economy: supply data for storage and disposal facilities should reflect the full social cost of their use for this purpose relative to any other; demand data for the use of storage facilities must reflect the full social benefit of having waste go through one channel rather than some other; demand for and supply of reclaimed materials for recycling must reflect the full costs and benefits of rechanneling them back into production or consumption; and the markets for products competitive to recycled raw materials (mainly virgin raw materials) should reflect full social costs and benefits, as should the markets for the alternative uses of storage and disposal facilities. If these conditions are met (in addition to a few technical ones), then the problem of waste management will not arise. (MCW)

6862 **Inevitable energy.** Felix, F. (Soc Int de Technol, Paris, Fr). *Rev. Energ.;* 28: No. 294, 311-313(May 1977). (In French).

In order to satisfy the aspirations of all men for better assured general welfare and to face the expenses implied in social progress, the gradual increase of the gross national product is a necessity. The essential condition is an increase in productivity, and this cannot be conceived without a reasonable amount of energy consumed per job. Without energy, most workers would have to switch to non-mechanized and much less protective activities. This means less pay and a return to the living standards of the non-industrialized countries. It can be forecast that, from now until the end of this century, the consumption of energy will probably more than double. The article explores the relation between energy and gross national product in the USA and France.

6863 **Energy saving in the investment policy of French enterprise: I. Formulation of the problem.** Castagne, M.; Picard, J.J. (Int Natl Polytech de Lorraine, Fr). *Rev. Energ.;* 28: No. 294, 314-318(May 1977). (In French).

After formulating and then mathematically formalizing the problem of energy saving as it arises in French industry, the article shows the principal limits of investment policies actually practiced by French firms.

6864 **International energy trade: recent history and prospects.** Schneider, H.K. (Univ. of Cologne). *Annu. Rev. Energy;* 2: 31-65(1977).

A numerical comparison on the primary energy consumption and the primary energy production of the world's major regions indicates the importance of the economic factors that, by affecting foreign trade, govern the international flow of energy; a detailed analysis is given. Several phenomena are noteworthy: (1) North America is the primary energy consumer (one-third of total world consumption); this region's high degree of overall self-sufficiency conceals a continually decreasing degree of self-sufficiency in hydrocarbons; (2) the import dependence of Western Europe and the Far East, in particular Japan, is high and steadily rising; (3) the Middle East is the paramount exporter of primary energy; and (4) the relationship between production and consumption in the communist part of the world, including the Soviet bloc and China, is constant, and results in a slight surplus. The regional disaggregation on which this summary is based derives exclusively from geographic criteria, and not from the criterion of a homogeneous supply or consumption position for primary energy, which is sometimes very different among countries of one region (for example Indonesia and Japan in the Far East). Therefore, total foreign trade in primary energy has a substantially larger volume than could be concluded from a simple regional breakdown. 38 tables, 4 figures, 26 references.

6865 **Location of energy-related industries in Western Europe.** Molle, W.T.; Breimer, H. (Netherlands Economic Inst., Rotterdam). pp 58-77 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

A study was made of the changes caused by outside factors, such as regional development, military strategy, and balance of payments, on the location patterns of energy-related facilities in Western Europe since World War II. The most striking change has been the rapid rise in energy consumption and the replacement of imported oil for coal as the major energy source. Refineries, mostly in coastal locations, are seen to be located for marketing rather than located where crude oil is produced. Large plants tend to be supply-oriented and located near the refineries, although petrochemical plants and the steel industry are also located near their own markets. A growing awareness of environmental considerations and the "energy crisis" are relatively recent factors whose impact is not yet known. Historical data gathered from the Organization for Economic Cooperation and Development (OECD) statistics traces the changes in primary fuel consumption and the changes in consumption patterns by industry as a whole as well as the iron-and-steel and chemical industries. 10 tables, 1 figure, 37 references. (DCK)

6866 **Regional balanced growth in Italy and the increase in oil prices.** Brown, M.; Di Palma, M.; Triulzi, U. (State Univ. of New York, Buffalo). pp 78-89 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

The short-term impact of higher fuel prices on the Italian economy is analyzed for the years 1951 to 1974 in the context of regional development. Regional analysis of income, worker income, and sectoral productivity indicates a steady decline in the agricultural sector and a corresponding rise in services and transport. Industry has likewise declined in favor of construction and services in most regions. A simulation model weighing regional value-added and capital used for production to determine the impact of fuel prices indicates that all 19 regions were affected, but not uniformly. Poorer regions in the south appear to have felt the impact more severely than the northeast and central regions. These patterns are not expected to continue over the long run, but should be taken into account in planning for a balanced regional growth. 3 tables, 5 references. (DCK)

6867 **From wages to badly circulating rent.** Heesterman, A.R.G. (Univ. of Birmingham, England). pp 220-249 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

Rent, defined as an imputed value, is considered to have been underestimated for natural resources in view of their scarce supply. Rent for exhaustible resources, such as mines, represents a value per ton placed on the ore that will be exploited until it is depleted and should, therefore, be considered as a cost of production. Rental value, defined in economic terms by Ricardian as a function of quality and by Walrasian as available natural supply, is not felt to more realistically apply to the Walrasian theory. Comparisons are made between the rental values based on replacement cost, serve containment, and reserve depletion of indestructible and exhaustible resources. The major environmental restrictions on economic development are food production, pollution, pesticides, heavy metals, dust and carbon dioxide, ozone, nuclear power and nuclear wastes. Ignorance of the detailed impacts of these activities can make it difficult to apply an appropriate rental value. A guideline is proposed to aid in assigning rent to raw materials, specifically oil and food, and explores the economic impact of price changes. A lack of world-wide coordination causes the problem to be handled as a social-political rather than an economic issue and indicates the need for a world economic authority and monetary system. (DCK)

6868 **Determination of social costs of environmental damage.** Mastenbroek, A.P.; Nijkamp, P. (Erasmus Univ., Rotterdam). pp 262-290 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

Economic analysis tools are applied to the evaluation of environmental damage by internalizing pollution costs rather than dealing with them as external side effects. An implicit optimal approach to assigning damage costs in the form of effluent standards is programmed so as to incorporate the economics of pollution into production and consumption decisions. Impact analysis is used to calculate the specific effects of a project, such as a highway, in terms of accessibility and demand for labor and damage to natural areas. The complexity of public decisions led to the development of multiple criteria, which result in efficient solutions (i.e., multi-objective), but not a single solution. This is based on the assumption that the environment represents a common property good that is threatened. The concept of "shadow" costs allows an economic value to be placed on social values. The decision makers must then choose a final solution from the efficient solutions. 3 figures, 3 tables, 47 references. (DCK)

6869 **Changing economics of world energy.** Abrahamsson, B.J. (ed.). Boulder, CO; Westview Press, Inc. (1976). 179p. (CONF-7506123—).

From Rocky Mountain Petroleum Economics Institute conference; Vail, Colorado, United States of America (USA) (29 Jun 1975).

The seven papers presented in this book were originally given at the 1975 Rocky Mountain Petroleum Economics Institute, Vail, Colorado, June 29 to July 2. It focused on the international energy

situation and the resulting problems for a national energy policy. Following an introductory paper by Dr. Bernhard J. Abrahamsson, the papers are: The World Oil Environment--Still in the Throes of Change, Milton Lyston; The Economics of Interfuel Competition, Richard J. Gonzalez; Coal--Energy of the Past or Future, John E. O'Leary; The Future Role of Electricity, Helmut J. Frank; The U.S. Petroleum Supply: 1975 to 1990, R. Gale Daniel; The Role of Conservation in the Changing Economics of Energy, John Gibbons and Roger W. Sant; and The Cost of Implementing the EPA's Environmental Regulations and Programs, Paul H. Brands. (MCW)

ENVIRONMENT, HEALTH, AND SAFETY

REFER ALSO TO CITATION(S) 5971, 6851, 6861, 6865, 6868, 6878, 6887, 6918, 6970, 7385, 7405, 7426, 7439

6870 Emission standards and price distortion. Kohn, R.E. (Southern Illinois Univ., Edwardsville). *J. Environ. Econ. Manage.;* **4**: No. 3, 200-208(Sep 1977).

A simple model is presented which demonstrates that emission standards can either reduce or increase the distortions inherent in preregulatory relative prices. This model is used in conjunction with data for controlling air pollution in the St. Louis airshed under a least-cost set of emission standards. By applying a heuristic formula, it is concluded that this set of standards is distortion neutral. Although there is reason to believe that conventional emission standards are distortion-reducing, it is clear that Pigouvian fees achieve technical efficiency in abatement as well as the elimination of price distortion. 19 references.

6871 Impact of production and use of energy on the global climate. Bolin, B. (Univ. of Stockholm). *Annu. Rev. Energy;* **2**: 197-226(1977).

Based on study by author, entitled "Energy and climate", carried out under auspicies of Secretariat for Future Studies, Stockholm.

The increasing production of energy by man has begun to modify significantly the environment that the earth naturally offers man. At first the environmental effects were local, limited to cities and industrial zones. In recent years, however, cities and industries have grown rapidly and they extend now over considerable areas, so that man's influence on the environment has become regional. This review of possible global climatic changes has included the effect of direct heat emissions into the atmosphere as a result of man's increasing energy production and the importance of carbon dioxide and particles in the atmosphere. There are, however, many other ways in which man may influence the climate, which are presented in both the scientific literature and the popular press. A closer study of the literature shows, however, that scientists at present do not agree on the correctness of most of these theories; some of them may be correct in principle, but massive research efforts are required to clarify this and above all to estimate their quantitative importance. Thus, the statements about clear interrelations between man's activities and climatic changes that have occurred lately cannot at present be accepted as sufficiently well documented. Only through global cooperation between governments and the scientific community can we hope to understand gradually the interplay between the many mechanisms at work in the climatic system. The very possibility that significant changes will take place within 100 years, maybe within 50 years, is an exceedingly important fact. Within another decade or two, reality will most likely show how relevant this fact is. Even now we must pay due regard to the possibility of change when planning our future energy supply, above all by retaining the utmost degree of flexibility. 3 tables, 11 figures, 34 references.

6872 Risks and benefits from lead in gasoline: effects on energy use and environment. Resek, R.W.; Provenzano, G. (Univ. of Illinois, Urbana). pp 291-306 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

The environmental and economic effects of lead additives in gasoline are examined to determine the relative dollar value of risks to agriculture and public health compared to the benefits in automobile efficiency. Agriculture is affected by lower crop yields (or additional expense to avoid reduced yields) and the presence of lead in food. Lead concentrations on the ground are determined by the number of automobiles passing and the distance from the road bed, but the effect is cumulative and will increase with time. Liming of the soil to reduce acidity is not only a good farming practice, but counteracts the presence of lead. The cost of extra liming, then, can counteract some of the loss in profits from reduced yields. Because only small amounts of lead are taken up by a plant and transmitted to the edible portions and surface dust can be removed by washing, there appears to be little monetary risk. Urban areas have higher concentrations of automobile emissions and dusts from lead-based paints, but no conclusive data is available. In contrast to these risks, lead additives have improved both refinery and automobile efficiency and government policies banning lead additives for environmental reasons will be reflected in economic losses that are intensified by oil import quotas. Peter M. Meier of Brookhaven National Lab. comments on the policy questions and methodological problems raised in this paper. 9 references. (DCK)

6873 Technological abatement vs. locational adjustment: a time-space dilemma. Parvin, M.; Grammas, G.W. (Fordham Univ., New York). pp 194-216 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

A mathematical model is used to examine Consolidated Edison's experience with pollution control in New York City to compare the costs of relocation and technological abatement measures. Technological abatement in the form of new production factors, such as higher grades of fuel, or new processes, or a combination of both, will affect the level and composition of pollution per unit of production. Locational adjustment involves relocation, modification in technology with relocation, or replacement of a plant to change the spatial distribution but not the level of pollution and its costs. Results of the New York regional study indicate that locational adjustment has met with public resistance in spite of abatement technology. The conclusion is reached that locational adjustment is, at best, only a short-term solution. Responsibility for pollution should be allocated on the basis of consumption, which is the reverse of rate structures granting lower unit prices to large users. 12 tables, 26 references. (DCK)

6874 Urban design shaping the environment: a note. Music, V. (Urbanization Inst., Ljubljana, Yugoslavia). pp 315-316 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

The world-wide energy crisis has caused an awareness of the constraints energy imposes on the natural environment and the urban infrastructure and has prompted a re-evaluation of the roles of energy within that structure. New policies are shaping the use of energy for transportation, production, street lighting, etc. The question is posed as to whether institutional attention has been slow to explore the impacts of high energy prices out of fear that social and political values will need changing. Urban self-management programs that involve public participation have been started in Yugoslavia in order to mesh the interests of planners and users. A list of design criteria is outlined which includes the concept of energy conservation and a plan for introducing and applying new energy sources. (DCK)

ENERGY RESOURCES

REFER ALSO TO CITATION(S) 5890, 6855, 6864, 6867, 6912, 6926, 6930

6875 (CONF-7609125—, pp 13p, Paper 8) **Use of mathematical models in allocating water for energy purposes.** Brill, D.E. (Univ. of Illinois, Urbana). 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

Developing energy resources and energy conversion facilities places a major demand on water resources. To efficiently allocate water to these energy demands requires giving attention to the interlocking energy and water resources systems. Mathematical models can be used to examine these two systems simultaneously. An example model that is discussed deals with electricity generation and transmission and pipeline gas production and transmission as well as water resources development for these purposes and additional ones. This example is used to discuss the role of mathematical models as tools to assist in planning water resources development.

6876 (CONF-7609125—, pp 18p, Paper 19) **Development of water resources to production of oil and gas in Taiwan.** Nee, C.; Liu, C.L. (National Cheng Kung Univ., Tainan, Taiwan). 1976.

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

In this paper, the economic situation before and after the energy crisis is reported. Electricity and oil are urgently needed. Supplies of energy will mainly depend upon nuclear power and pumping storage system as well as offshore oil production. Oil refining and petrochemicals are key industries in this country. Optimization technique of pumping storage in combination with other generation is discussed.

6877 (CONF-7609125—, pp 17p, Paper 21) **Water production and petroleum and natural gas development and production in the German Federal Republic.** Rottgardt, D. (Gewerkschaften Brigitta u. Elwerath—Betriebsfuehrungsges mbH, Hanover). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The interrelated problems of water economy and purity and petroleum and natural gas production, including enhanced recovery techniques requiring water, are discussed as they apply to a highly industrialized country in northern latitudes. (JSR)

6878 (LA—6688-MS) **Water requirements for future energy development in the West: state perspectives.** Gertsch, W.D.; Sathaye, J.; Ritschard, R.; Parker, S. (Los Alamos Scientific Lab., N.Mex. (USA)). Aug 1977. Contract W-7405-ENG-36. 57p. Dep. NTIS, PC A04/MF A01.

This survey for the U.S. Water Resources Council presents a summary of state views on the sufficiency of western water resources for energy development in the West. Possible impacts and problems associated with the commitment of water to energy use are also identified for California, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming. 46 references.

6879 (USGS—1005) **Lithium resources and requirements by the year 2000.** Vine, J.D. (ed.). (Geological Survey, Denver, Colo. (USA)). 1976. 162p. (CONF-760112—). GPO.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

Lithium resources and requirements are evaluated on the basis of projected energy scenarios and energy sources. The majority of contributions to the conference discussed lithium ores and abundances in various rocks and ground waters. No individual abstracts were prepared for Energy Abstracts for Policy Analysis (EAPA), but some papers were selected for Energy Research Abstracts (ERA). Four papers were processed previously. (JSR)

6880 **Profitability of exhausting natural resources.** Puu, T. (Umea Univ., Sweden). *J. Environ. Econ. Manage.;* **4**: No. 3, 185-199(Sep 1977).

Two models are treated. One deals with a mineral deposit, the other with a biological substance. It is assumed that in the deposit there exist all grades of ore, and that the biological substance grows as long as a positive quantity is left. The course of investment and production decisions is derived when capital is expressly built up for the purpose of exploitation of the specific resource. Within the simple linear control problem it is concluded that exhaustion is never profitable. The steady state in the biological case is discussed and compared to maximum sustainable yield.

6881 **Effect of tax laws on mineral exploration in Canada.** DeYoung, J.H. Jr. (Geological Survey, Reston, VA). *Resour. Policy;* **3**: No. 2, 96-107(Jun 1977).

It is concluded that tax law variations, rather than differences in commodity price changes, have been responsible for shifts in mineral exploration from one political region to another. This view is substantiated by the fact that decreasing mineral exploration in certain parts of Canada has coincided with increased mineral exploration in areas of the USA and in other parts of Canada, and with diversification by mining companies into non-mining activities. It is difficult to analyze separately the effect of all the different considerations facing the managers of the exploration budgets. These decision makers are concerned with the possibility of discovering ore deposits by using available methods; with the costs of finding, acquiring, developing, producing, and marketing mineral commodities; and with expected revenues from product sales. Budget-allocation decisions by those engaged in exploration are influenced by many characteristics of a region including: geology, topography, climate, population density, political structure, applicable legislation on zoning, taxation, and environmental controls, and transportation facilities. The decline in mineral exploration in Canada, particularly in British Columbia, which followed increases in taxes for mining companies has provided policymakers with several examples that should be considered in the development of future mineral policies. These examples are discussed.

6882 **Mineral commodity stabilization: the producers' view.** Radetzki, M. (Univ. of Stockholm). *Resour. Policy;* **3**: No. 2, 118-126(Jun 1977).

Certain conditions have been determined under which it may be advantageous for producers to build up stocks by keeping output above supply in periods of low demand. Ceteris paribus, the conditions for such stock-building become more favorable the lower the level of marginal production cost, the lower the cost of storage, the higher the level of demand during the boom when the stocks are sold, and the higher the price elasticity of demand when the stocks are disposed of. Buffer stocks will always be less advantageous than production cuts when the price elasticity of demand is less than -1.0 at the time of disposal, even if stockholding costs are disregarded. Global price elasticities of demand in most mineral markets are very low. It may be concluded that mineral producers in such markets are likely to derive a collective disadvantage from market stabilization through buffer stocks, and that their interests would be better served by production cuts in response to falling demand.

6883 **Long-term adequacy of metal resources.** Singer, D.A. (Geological Survey, Menlo Park, CA). *Resour. Policy;* **3**: No. 2, 127-133(Jun 1977).

Long-term adequacy of supply of metals from the earth is dependent on three fundamental factors: the amount of metal available in the earth's crust in each range of grades; the mineralogical and chemical state of the metal; and the spatial distribution of the metal. The question, then, is whether enough is known to estimate when the three factors could affect the supply of a metal. To a limited extent, information about the three fundamental factors can be obtained from grades and tonnages of mineral deposits. Average grades, tonnages of total material, and tonnages of contained metal in mineral deposits are all approximately lognormally distributed in each type tested. A lognormal distribution of tonnage suggests that deposits of a particular type occur less frequently as tonnage increases beyond the median. Tonnages are independent of average grades for most deposit types studied. Since a finite number of deposits of each type must exist, society may exhaust each kind as its exploitation becomes economically feasible. In the future the need will arise to rely on silicate minerals for some metals now produced from non-silicate minerals. This will present at least two problems, the very difficult environmental problem, and the need for vastly more energy to produce a unit of metal. This could have serious consequences unless the price of energy becomes much lower than it is today. Society will not deplete its physical supply of any particular metal. Certainly, those who say that metals will always be available at some price are correct.

6884 **Global energy resources.** Grenon, M. (International Inst. for Applied Systems Analysis, Laxenburg, Austria). *Annu. Rev. Energy;* **2**: 67-94(1977).

We are in the somewhat paradoxical situation of having more confidence in the extent of our long- or very long-term energy resources than in our mid-term supply. This is why fossil-energy resources are emphasized in this article; we must rely on them for at least 80 to 90% of our energy supply until the end of the century (as far as commercial energy is concerned), and for a continuing, although probably decreasing, portion of that supply well into the next century. Let us not forget that the progressive shift to new kinds of energy involves two parallel industrial mutations: one at the production or conversion level (i.e., to produce electricity or hydrogen with nuclear reactors instead of coal thermal plants), and the second at the distribution and utilization level. As a whole, the fossil resource base is definitely very large and it can last for many decades, or longer. However, to achieve a transition to the long-term sources by means of harvesting the remaining fossil resources, a major effort will have to be made to obtain a better knowledge of their true amount, location, identification, and other characteristics. Two major points deserve attention: (1) the energy supply problem has increasingly become an international issue because of its nature and dimensions, and because of the size of the investments needed for exploration, for research and development in extraction methods, and for the upgrading processes of these energy resources; and (2) how can nations select the optimum sequence of development and harvesting of these vast energy resources; our methods of decision-making seem inadequate for the task. Further, the management of energy resources should be integrated into a broader context, that of the management of all natural resources. 8 tables, 5 figures, 35 references.

6885 **Energy and food.** Pimentel, D. (Cornell Univ., Ithaca, NY); Terhune, E.C. *Annu. Rev. Energy;* **2**: 171-195(1977).

Available data on energy use in the world food system are assessed, and needed energy inputs for the future are projected. The amount of energy required to produce the world's food depends on the amount of available land and water, as well as on the size of the population. The world's population is expected to double during the next 37 years. During this interval, energy requirements for the world food system are expected to increase from the current 25% to 35-40% of each year's total energy use. Declining soil fertility,

increased need for irrigation, and diminishing returns from additional fertilizer are expected to account for the increased need for energy. Considerable additional energy and materials are required to produce the capital equipment—farm machinery, fertilizer and chemical factories, oil tankers, refineries, railroads, trucks, highways, etc.—necessary for increased world use of energy-intensive agriculture. Whether this equipment can be assembled soon enough in the 37-year population-doubling time to be effective is, of course, another question. In India, for example, lead time in construction and starting of fertilizer plants has averaged 5 years. Furthermore, new plants in Asia have generally operated at an average of only 60% of planned capacity, due to inadequate electricity supplies, inefficient plant design, and "difficulties with management and labor." Increasing food production to feed the estimated half-billion malnourished people alive today, as well as to provide for expected increases in population, will require that agricultural production be intensified. The increased production will have to come from the less-developed countries, rather than from the developed countries with industrialized agriculture, and this increase must come mostly from increased energy inputs. 1 figure, 14 tables, 103 references.

6886 Survey of United States and total world production, proved reserves and remaining recoverable resources of fossil fuels and uranium as of December 31, 1975. Parent, J.D.; Linden, H.R. Chicago; Institute of Gas Technology (1977). 50p. (NP—22361).

In-house study supported by IGT members, contributors, and international associates.

IGT's estimates of world and U.S. proved reserves and remaining recoverable resources are given. In no case should current resource estimates be considered final, since production, exploration, and development cause continuous changes. Exploration has been very uneven geographically. The values assigned to proved reserves and potential additional resources depend on technological and economic considerations as well as on physical characteristics and sizes of the deposits. The currently significantly increasing wellhead prices of gas and oil and of coal prices at the mines should lead to appreciably enhanced economic incentives to explore and produce and, thereby, to significant increases in recoverability of deposits in place and to increased discovery rates. The U.S. proved and currently recoverable fossil-fuel energy reserves amounted to 5.64 Q (10^{18} Btu). This compares favorably to the world figure of 20.9 to 21. Q. The estimated U.S. total remaining recoverable fossil-fuel energy resources of 28.6 to 45.6 Q compare roughly proportionally to the world total of 107.5 to 122.5 Q.

6887 World energy situation. Chatterji, M. (State Univ. of New York, Buffalo). pp 1-31 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

An overview of the conference outlines the growing concern for developing and allocating the world's energy resources in the context of meeting human needs in ways that are economically, politically, morally, and militarily acceptable. Both tangible (air, forests, water, etc.) and intangible (technology, culture, ethics, etc.) resources must be viewed as interrelated with energy. Energy resources and projected supply and demand levels for selected countries and the world as a whole are outlined in this context. Data are given for the United States, Japan, and Yugoslavia. Environmental degradation and health hazards are explored as direct impacts of resource exploitation. Economic models are used to project the consequences of alternative resource development strategies on the environment, energy supplies, and the economy. Policy recommendations are made on the basis of these analyses. Emphasis is placed on the need for a world energy policy that acknowledges these interdependencies and replaces confrontation with cooperation. 28 tables. (DCK)

RESEARCH AND DEVELOPMENT

6888 (CONF-760360—) **Opportunities at ERDA for small R and D companies. Small business proceedings.** Cardon, S.Z.; Lovejoy, S.D. (American Association of Small Research Companies, Washington, D.C.). 1976. 289p. Dep. NTIS, PC A13/MF A01.

From Conference on opportunities at ERDA for small R and D Companies; Washington, District of Columbia, United States of America (USA) (24 Mar 1976).

The following results of the conference were identified in order to determine future courses of action that must be pursued. Improvements must be made to reduce the spectrum of procurement barriers which make it difficult, and in some cases, impossible for small companies to deal with ERDA. The full spectrum of issues concerning the handling of unsolicited proposals, the main source of innovative input from the small company, must be resolved and problems in dealing with these proposals reduced. All ERDA personnel involved with the evaluation and awards of contracts for R,D and D must reflect the commitment of the Administrator to implement a greater degree of interaction between ERDA and small business. ERDA management, working with American Association of Small Research Companies must initiate administrative actions which will aid operational personnel in fulfilling this commitment. The AASRC must remain an articulate voice representing the legitimate concerns of the small business technical community in dealings with both the Executive and Legislative branches of government. ERDA should initiate a mechanism of defining the problems for which they feel that the community can be of major assistance in developing the solutions. Perhaps new mechanisms to widely disseminate this information should also be developed. (MCW)

6889 (ORNL/EIS—116) **Energy directory of organizations and researchers in Great Plains/Great Basin area (Arizona, Colorado, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah, Wyoming).** Caton, G.M.; Michelson, D.C.; Danford, G.S.; Frogge, L.M. (comps.). (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 53p. Dep. NTIS, PC A04/MF A01.

The directory lists research institutes and researchers involved in energy R and D in Arizona, Colorado, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah, and Wyoming. The first section of this publication, Organizations and Researchers, lists the names of colleges and organizations which are involved in energy R and D in these ten western states. The name of the organization is arranged in alphabetical order and printed below each organization are the name(s) of the researchers in the organization, their phone numbers if known, and the titles of their research projects. Section 2, Research Organizations by State, lists the research organizations performing energy R and D within each of the ten states mentioned. The alphabetical arrangement is first by state and then by research organization.

6890 (ORNL/EIS—118) **Energy directory of researchers in Great Plains/Great Basin area (Arizona, Colorado, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah, Wyoming).** Caton, G.M.; Michelson, D.C.; Danford, G.S.; Frogge, L.M. (comps.). (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 163p. Dep. NTIS, PC A08/MF A01.

The directory lists in Part 1 names of researchers involved in energy R and D in Arizona, Colorado, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah, and Wyoming by category. Within each category each researcher is given with his phone number when known, his affiliation, the title of his research, and publication information. These categories are listed and defined in ERDA Energy Information Data Base: Subject Categories, TID-4584-R2 (May 1977). In Part 2 the principal investigators are arranged by the state (two-letter state abbreviation) in which the research is performed. Researchers are alphabetically listed by the first author. If research on a project is performed in more than one state, the abbreviations for all the states involved will appear with the names of the project's principal investigators listed below. Indexes included are an investigator index, a research institute index, and a location index.

6891 (PB—265125(Pt.2)) **Inventory of energy research and development: 1973—1975. Volume I, Serial U. Part II.** (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-ENG-26. vp. (NSF/RA—760493(Pt.2)). NTIS, PC A99/MF A01.

This inventory provides an overview of the R and D being performed in every aspect of energy exploration, production, distribution, use, and conservation. Volume I Part II is devoted to bibliographic entries (including abstracts) concerning oil shales, tar sands, nuclear fuels, solar energy, geothermal energy, hydroelectric power sources, and synthetic fuels. This inventory expands and updates two earlier inventories of ongoing energy research published in March 1972 and January 1974.

6892 (PB—265126(Pt.2)) **Inventory of energy research and development: 1973—1975. Volume II, Serial U. Part II.** (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-ENG-26. vp. (NSF/RA—760494(Pt.2)). NTIS, PC A99/MF A01.

This inventory provides an overview of the R and D being performed in every aspect of energy exploration, production, distribution, use and conservation. Volume II, Part II contains sections on electric power transmission and distribution and on electric power planning, engineering, and operations. In the section on energy uses and conservation the following energy uses are treated: heating and cooling; lighting; applicances and equipment; industrial and manufacturing processes; transportation; agricultural; medical; military; and communications. This inventory expands and updates two earlier inventories of ongoing energy research published in March 1972 and January 1974.

6893 (PB—265127(Pt.1)) **Inventory of energy research and development: 1973—1975. Volume III, Serial U. Part I.** (Oak Ridge

National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-ENG-26. vp. (NSF/RA—760495(Pt.1)). PC E99/MF E99.

This inventory provides an overview of the R and D being performed in every aspect of energy exploration, production, distribution, use and conservation. Volume III, Part I includes the following: Section IV--Economic and Legal Aspects; Section V --Environmental and Health--Energy Related. Section IV includes abstracts on: (1) supply, demand, and forecasting; (2) economic feasibility; (3) policy, legislative, and regulatory aspects; and (4) technology assessment. Section V contains chapters on: (1) air pollution; (2) water pollution; (3) noise; (4) oil spills; (5) transportation exhaust studies; (6) transportation emissions control; (7) waste product utilization and waste disposal; (8) mine safety; (9) land reclamation; and (10) general studies and aesthetics. This inventory expands and updates two earlier inventories of ongoing research published in March 1972 and January 1974.

6894 California energy trends and choices. Volume VI. Energy research and development program. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 165p. (NP—22638/6).

Volume 6 continues the report on policies and recommended actions for a number of the program areas—solar energy, geothermal energy, fuels from coal and biomass, and fuel cells—and options for power plant cooling. It is a very exhaustive description of the total research and development program, treating conventional and alternative energy sources, energy demand and conservation, energy efficiency, facility siting, and other areas. It describes objectives, major accomplishments 1975 to 1977, and proposed projects aimed at meeting those objectives. (MCW)

NUCLEAR ENERGY

REFER ALSO TO CITATION(S) 6019, 6030, 6031, 6032, 6033, 6034, 6035, 6036, 6037, 6038, 6039, 6040, 6041, 6042, 6043, 6044, 6045, 6046, 6047, 6051, 6065, 6070, 6072, 6081, 6085, 6092, 6575, 6588, 6589, 6675, 6676, 6677, 6886, 6964

6895 ERDA seeking safe, long-term nuclear options. Thorne, R.D. (Energy Research and Development Administration, Washington, DC). *Energy User News;* **2**: No. 35, 22(5 Sep 1977).

Alternative approaches to nuclear power generation that will use non-weapons material are under study by ERDA. Agreement was reached after a study of the options that long-term fission should be preserved, reactor technologies meeting the administration's nonproliferation goals should be researched, and it should be recognized that there is no way to achieve complete non-proliferation. A redirected program will concentrate on improving light water reactors (LWRs) and identifying and developing less risky nuclear options. The Non-Proliferation Alternative Systems Assessment Program is reviewed in terms of its objectives and procedures. October of 1978 is the target date for making recommendations based on the studies and for conducting national and international discussions of the proposal's merits. Another study, the International Fuel Cycle Evaluation Program, will broaden the assessment. Near-term goals include more-efficient utilization of LWR fuel and the use of thorium fuel. The study of alternative concepts will include converter, advanced converter, and breeder options, with emphasis on new ways to reprocess fuel and manage wastes. (DCK)

6896 Costing of nuclear power. *Important for the Future;* **II**: No. 2, 9-11(Apr 1977).

No generally accepted method for costing nuclear power has been agreed upon. Nuclear power stations also have certain cost items that do not exist for other types of power generation and should not be forgotten in a comparison of nuclear generating costs with non-nuclear generating costs. Therefore, 10 cost items that are higher in the case of nuclear power stations or do not exist in the case of non-nuclear power generation stations are discussed briefly. Some of these cost factors are not always included in nuclear power costs because such costs are borne by governments. The cost items discussed are: capital cost, repair and maintenance, capacity factor, the cost of long construction periods, insurance, land cost, disposal of radioactive wastes, dismantling nuclear power stations, protection, and training. (MCW)

6897 First law of uranium dynamics. De Bruin, H.J. (Flinders Univ. of South Australia, Bedford Park). *Int. J. Energy Res.;* **1**: No. 2, 233-248(1977).

Pressures are mounting to lift the embargo on the export of Australia's vast uranium mineral resources. A Royal Commission, after investigating all aspects of uranium mining and exports, submitted the report. It is suggested that nuclear power be accepted as an interim solution to the world's energy problems. The plutonium breeder technology is rejected as an ultimate solution. Meanwhile, the striking of a $750 (Australian) export levy per ton of uranium ore will provide the funds for research and development in the use of renewable energy sources. Restrictive conditions imposed on the sale of uranium minerals and their derivatives include guarantees against the separation of plutonium and the development and use of a plutonium technology. 42 references.

6898 International safeguards problem. Scheinman, L. (Dept. of State, Washington, DC); Curtis, H.B. *Annu. Rev. Energy;* **2**: 227-238(1977).

To recognize the limitations of safeguards as a barrier to nuclear proliferation is not to deny their essential role in the effort to contain that problem. Without a safeguards system, international nuclear commerce and development would not, indeed could not, be what they are today. The problems evoked in the discussion of the spread of sensitive nuclear technology underscore the importance of ensuring that activities do not outpace our ability to control them. To sustain a global nuclear economy requires a readiness to live within the constraints that such an economy requires. Enhanced safeguards and strengthened national commitments to facilitate their application are key elements of those constraints. So also may be a prepardness by many nations to forego explicitly national control over all facets of the nuclear fuel cycle while still sharing fully and equally in the benefits of the peaceful atom. The challenge of the coming years will be to craft mechanisms and institutions enabling the continued growth of peaceful nuclear activity without further impairing international security. The constraints that such an outcome entails are not limited to nations lacking sophisticated nuclear technology; they apply to the most advanced nuclear nations as well—partly through adherence to the safeguards system that these countries call upon others to adopt, and partly through greater willingness to entertain solutions that may involve greater international involvement in, and control over, their own peaceful nuclear productive activities. With time, the relative incompatibility of nuclear energy with full national sovereignty, and the far-sighted wisdom of the Baruch Plan, are becoming increasingly clear. 1 table, 10 references.

6899 Nuclear dilemma: energy, the atom, and survival. Church, F. (United States Senate, Washington, DC). *Electr. Perspect.;* No. 4, 12-17(1977).

Senator Church takes the position that, since the nuclear threat already exists, the United States should be a leader in the effort to set international limits on its control. He notes that while large power plants, and especially nuclear plants, may be economically unfeasible, such other economic forces as competition from countries that are expanding their nuclear capability may force us to continue our own nuclear programs. The breeder reactors that are replacing depletable oil in other countries have already started the plutonium age, which the U.S. cannot turn back with offers of depletable enriched uranium. Experimental reprocessing plants in several countries have raised safeguards concerns that were not realistically assessed by the administration in Senator Church's opinion. His recommendations for proliferation safeguards are (1) an international safeguards and physical security system to minimize diversion risks, and (2) assurances to developing countries that they will have access to enrichment and reprocessing services. (DCK)

6900 Voter attitudes on the 1976 California nuclear initiative. Groth, A.J.; Schutz, H.G. Davis, CA; University of California (1976). 62p. .

This study of public attitudes on the Nuclear Power Plants Initiative in California was conducted after the election of June 8, 1976, in order to discover how some of the issues relating to the initiative were perceived by different segments of the electorate. Proposition 15 called for more stringent regulation of the nuclear power industry in this state under the auspices of the legislature. It was defeated in the June 8 election by a margin of approximately 2 to 1, with a margin of defeat that was significantly higher in the southern part of the state than in the north. In Sacramento County, where the study was conducted, the result was 60 percent against the proposition and 40 percent in favor. This north-south split has long been recognized in both national and state elections as something of a liberal-conservative division; while the findings of this study are not limited to this concern, they generally confirm a broad linkage between conservative political identifications and attitudes and opposition to the Nuclear Power Plants Initiative. The nine chapters of this report deal with the survey methodology, an overview of the electorate, a demographic profile of Yes and No voters, attitudinal differences between proponents and opponents, the conservation question, socio-political characteristics, and information sources and credibility. The study ends with a brief summary and conclusion.

TRANSPORT AND STORAGE

REFER ALSO TO CITATION(S) 5979, 6821, 7066

WASTE HEAT UTILIZATION

REFER ALSO TO CITATION(S) 6905, 6923

6901 (COO—4211-1/1) **Preliminary feasibility study of a grid-connected integrated community energy system at Clark University. Volume I. Executive summary.** (Clark Univ., Worcester, Mass. (USA)). Jul 1977. Contract EC-77-C-02-4211. 58p. Dep. NTIS, PC A04/MF A01.

A feasibility study of grid-connected co-generation (ICES) was conducted at Clark University. A summary of the accomplishments of Phase I shows that Clark University is attractive for an ICES demonstration project. Details of the study are summarized in five sections: preliminary energy and economic analysis, preliminary institutional assessment, conceptual design, commitments confirmation, and work management plan. (MCW)

CONSERVATION

REFER ALSO TO CITATION(S) 6929, 6935, 6939, 6976, 6998, 7026, 7027, 7044

6902 (CONF-770234—) **Energy conservation in the pulp and paper industry. Final report.** (Advanced Energy and Technology Associates, Dover, N.H. (USA)). May 1977. Contract W-31-109-ENG-38;31-109-38-3766. 104p. Dep. NTIS, PC A06/MF A01.

From Energy conservation in the pulp and paper industry; Durham, New Hampshire, USA (23 Feb 1977).

Almost 40 specific research and development ideas were formulated by the 67 participants at this workshop. Projects were assessed with the following criteria in mind: potential energy savings, cost, risk, Federal role, time frame, and priority. Data are tabulated on the projects followed by six topics discussed by panel members: waste and recycling, energy management in the mill, papermaking, pulping and bleaching, power generation in the mill, and coating and conversion. Three summary speeches are included. (MCW)

6903 (CONF-7509194—) **Energy conservation in Colorado.** Vogenthaler, T. (Colorado Energy Research Inst., Golden (USA)). 1975. 105p. TIC.

From Energy conservation in Colorado; Golden, Colorado, USA (17 Sep 1975).

The Workshop addressed what can and is now being done to achieve energy conservation in Colorado. Two seminar talks an the national and state levels and three additional ones on institutional, commercial, and industrial levels were presented addressing varied approaches to the conservation of energy. The objectives of this two-part Workshop included: the focus of public attention on programs now active within the state; the opportunity to exchange innovative ideas which are both fuel and cost effective; to consolidate approaches to energy conservation by sector.

6904 (CONS/1211—1) **Barriers connected with certifying or listing of energy-conserving products used in buildings.** (Hittman Associates, Inc., Columbia, Md. (USA)). May 1977. Contract EY-76-C-03-1211. 153p. (HIT—680). Dep. NTIS, PC A08/MF A01.

The report assesses the availability and implementation of energy conservation technology, particularly in the residential sector. Of concern is that energy-conserving innovations are restricted and, in some cases, blocked entirely from reaching the marketplace by a variety of institutional barriers. An ERDA-sponsored project to identify practical policy or program options whose implementation would increase the rate and degree of market penetration of these products is summarized. From research performed over a five-month period, the report describes the results of a survey of energy-conserving products and certification practices and procedures; energy-conserving products identified as being restricted; identification and analysis of the effects of these barriers; and the recommendations of policies and programs to mitigate the effects of the identified barriers. (MCW)

6905 (COO/2862—1) **Industrial applications study. Volume I. Executive summary: industrial waste energy data base technology evaluation. Final report.** (Drexel Univ., Philadelphia, Pa. (USA); United Technologies Research Center, East Hartford, Conn. (USA); Mathematica, Princeton, N.J. (USA)). Dec 1976. Contract EY-76-S-02-2862. 92p. Dep. NTIS, PC A05/MF A01.

The basic purpose of this study is the development of a national industrial data base and a rational basis for the determination of the costs and benefits associated with the use of low-grade-waste thermal energy in the industrial sector. In order to develop potential priorities of technologies, an initial evaluation of industrial energy utilization at the two-digit Standard Industrial Classification (SIC) level was established. The objectives of this study are: (1) develop a methodology for the establishment of a meaningful industrial energy data base and a means to evaluate it; (2) establish an initial industrial data base from which to characterize and correlate industrial energy utilization; (3) define near- and intermediate-term industrial waste heat utilization technologies; and (4) establish assessment and priority matrices of industrial technologies, industrial waste energy streams, and 2-digit SIC industrial groups. This volume presents a summary of the industrial data base (section B), technology data base (section C), and the evaluation (section D) of the energy conservation potential and paybacks for the various technology-industrial waste stream combinations.

6906 (ERDA—77-81) **Consumer Products and Technology Branch program plan.** (Energy Research and Development Administration, Washington, D.C. (USA)). Sep 1977. 36p. of Energy, Washington, DC.

The CPT program plan includes research, development, and demonstration activities in energy conservation, specifically, to encourage and manage R, D, and D of new energy-conserving technologies in heating, cooling, and ventilating equipment and systems; lighting and windows; appliances and other consumer products; controls; materials; telecommunications; and diagnostic equipment used to determine the efficiency of energy use in buildings. The Headquarters Programs on heat pumps, building diagnostics, and other projects are presented in Chapter 2. The programs at Oak Ridge National Lab. on appliances and analysis and information are described in Chapter 3. In Chapter 4, the program on building systems controls, materials, and space conditioning at Brookhaven National Lab. is discussed. Finally, projects on lighting and windows at Lawrence Berkeley Laboratory are described. (MCW)

6907 (HUD-PDR—89(3)) **In the bank...or up the chimney. A dollars and cents guide to energy-saving home improvements.** (Abt Associates, Inc., Cambridge, Mass. (USA)). Apr 1975. 78p. GPO $1.70.

Practical methods to conserve energy in space heating and cooling are presented for different types of houses. Cost estimates and resultant dollar savings in the first year are provided for each option. Installation methods are illustrated for each option to insure safety, permanence, and cost-effectiveness. Energy conservation techniques include caulking and weatherstripping doors and windows, installing storm windows, insulating attics and walls, and adjusting thermostat settings.

6908 (NBS-Handbook—115) **Energy conservation program guide for industry and commerce (EPIC).** Gatts, R.R.; Massey, R.G.; Robertson, J.C. (National Bureau of Standards, Washington, D.C. (USA). Inst. for Applied Technology). Sep 1974. 207p. Dep. NTIS, PC A10/MF A01.

An abstract for this document appears in EAPA 1:20. An abstract to NBS-Handbook-115 (Suppl. 1), dated Dec. 1975 appears in ERA 1:23563. 175 references.

6909 **Federal residential energy conservation programs: an analysis.** Hirst, E.; Carney, J. (Oak Ridge National Lab., TN). *Energy [s] Stamford, Conn.*; **2**: No. 3, 24-28(Sum 1977).

An engineering-economic model, when used to determine the impacts of three Federal programs on residential fuel consumption, indicates that most conservation efforts can save both energy and money without requiring any significant change in lifestyle. The model analyzes eight end uses of four different fuels in three types of housing as a result of (1) appliance efficiency targets set by the Federal Energy Administration, (2) thermal standards for new housing construction set by the Department of Housing and Urban Development, (3) financial assistance and demonstration of retrofitting in one-family units by these two agencies, and (4) a combination of all three programs. Results of the model, developed at the Oak Ridge National Laboratory, are summarized in several tables. The net effect of all three programs is shown to reduce energy growth through improved building and equipment efficiency without changing behavior and while allowing increased comfort in thermostat settings. Appliance efficiency offers the greatest opportunity for saving because of the short life span involved. A continuation of the program beyond 1980 is seen to offer even further benefits through the year 2000. 14 refs. (DCK)

6910 (NP—22485) **Energy conservation: a vehicle for change.** Slack, G.W. (Stanford Univ., Calif. (USA)). Win 1977. 16p. TIC.

A comprehensive energy conservation program applied to a fully-integrated energy system must, on the one hand, balance an economic equilibrium between reduced consumption, resource substitution, and increased efficiency of utilization, and on the other hand, make a judgment on both environmental quality (loosely defined) and integrability of the program into the organization. After a brief exposition on the engineering-system-design aspects of energy conservation, the remainder of the paper focuses on the need for a procedure to assess organizational posture towards program options.

6911 (TID—22791) **Home energy saver's program: a report on a demonstration project undertaken in Utah.** Jensen, G.F. (Utah Engi-

neering Experiment Station, Salt Lake City (USA)). Jun 1977. 418p. Dep. NTIS, PC A18/MF A01.

A demonstration project undertaken in Utah designed to test a Home Energy Saver Program (funded by the Federal Energy Administration) is described. The basic purposes of the program were: (1) to encourage and bring about a significant reduction in home energy use, and (2) to test the impact of various energy conservation research elements on homeowners' participation. The principal research elements tested were: direct mailing of HESP workbooks to single family homeowners; use of a telephone hotline; use of workshops; use of a coordinated media program; and use of church and community support. In addition, the impact of a contest drawing, designed to motivate homeowners to compute their potential annual energy savings, was tested. (MCW)

6912 (TID—27650) **International technology transfer: a discussion of opportunities, incentives, and barriers to international technology transfer and the role of the Federal Government in its promotion.** (Gordian Associates, Inc., New York (USA)). 1977. Contract EX-76-C-10-3869. 344p. Dep. NTIS, PC A15/MF A01.

This study is concerned with energy use in the industrial sector where traditionally high energy prices in many nations have resulted in considerable attention being paid to energy conservative industrial practices. Energy-conservative technology has gone through an early evolution and the innovative technology that has evolved in these countries has been available for transfer to others. In this study, the term "technology" is used to mean the application of knowledge to achieve practical results. Technology transfer as it applies to the movement and application of knowledge across national boundaries, and more specifically from foreign nations to the U.S., is dealt with. This represents a difference between this study and most others which deal with technology transfer, because the latter typically consider the case of transfer from highly developed nations to underdeveloped nations, where problems such as untrained labor forces exist. This study is primarily concerned with technology transfer among "highly developed" industrialized nations, and the problems and mechanisms are often different. The plastics, petroleum refining, steel and cement industries are used to provide examples of the potential for industrial energy conservation through the use of foreign technology, and to show the extent by which energy consumption has been reduced in specific cases. With these industry examples in mind, this study presents recommendations for actions which might be taken by the Federal government to encourage the transfer of energy-efficient technology from foreign industries to the U.S. context.

6913 **General plan for energy conservation in school districts.** Baird, T.M.; Dacko, K.L. *Aware;* No. 84, 2-5(Sep 1977).

A general proposal is given for school districts to assess their energy problems. Goals are outlined for reducing energy consumption both at the individual shcool level and for an entire system. The plan stresses involvement at all levels of the staff, as well as at the community. Obstacles and possible solutions are listed. The first task is to determine how much energy is used and in which areas of operation. A system to monitor energy consumption and make comparisons over time will need to be devised in order to evaluate the amount of real saving. An energy conservation program developed for school systems in Florida is summarized with its goals listed. (MCW)

6914 **Beam daylighting: an alternative illumination technique.** Rosenfeld, A.H. (Univ. of California, Berkeley); Selkowitz, S.E. *Energy Build.;* **1**: No. 1, 43-50(May 1977).

This article is concerned with the energy savings and peak power reductions associated with the maximum utilization of natural light. The general characteristics of diffuse daylighting are discussed in terms of a standard office plan. An innovative technique of daylighting using direct beam radiation from the sun is treated in some detail. Beam daylighting, at 100 lm/W, is found to be more efficient than fluorescent fixtures and is capable of being directed up to 30 ft inward from the exterior facade by reflective louvers or blinds. The estimated cost of the system is calculated to be equivalent to the savings in electrical energy costs within a three-year period. It is also noted that relatively small savings in electrical consumption for air-conditioning are a by-product of the utilization of such a system.

6915 **Energy savings due to changes in design of ventilation and air flow systems.** Hutchinson, F.W. (Univ. of California, Berkeley). *Energy Build.;* **1**: No. 1, 69-76(May 1977).

Procedures for the design of ventilation and air-flow systems are shown to be energy-wasteful. The cause lies both in the methodologies and their technical bases, and in the influence of other factors that enter into a final systems choice for a building (particularly economics). The issue of general outside air requirements is discussed. It is found that any system in which outside air supply is sufficient to control body odor necessarily meets oxygen requirements many times over, and that the ventilation rate can be reduced by about 45 to 60% if higher humidities are used. The long-standing belief that required ventilation flow rate for odor control must increase as air space per occupant decreases has previously been proven untrue. New standards, including a rate of 7.5 cfm/person of outdoor air (not conditioned) during the heating season, are proposed based on the result that the ventilation rate is independent of air space per person. Air distribution systems and sub-systems are analyzed in terms of minimum energy requirements. Energy saving by velocity reduction is discussed. Fan power requirements for a high-velocity air distribution system are increased by 2500% over that for a low-velocity system in commercial buildings. A comparison of the "old" ASHRAE definition of Effective Temperature, which serves as a thermal comfort criterion in AC systems design, is made with the "new" definition, and the consequent energy savings that should result when the "new" definition is accepted in practice is demonstrated.

6916 **Energy savings and peak power reduction through the utilization of natural ventilation.** Milbank, N.O. (British Research Station, Garston, Eng.). *Energy Build.;* **1**: No. 1, 85-88(May 1977).

This paper is concerned with the factors involved in utilizing natural ventilation to the maximum extent possible in order to reduce the need for air conditioning and mechanical ventilation. It is noted that predicting a building's cyclic response is a difficult procedure, but that simple methods such as the Admittance Procedure have been developed. Thermal comfort studies have indicated the acceptability of the larger daily temperature variations associated with natural ventilation. The characteristics of possible new control systems are discussed. Characteristics and data on non-structural external solar products are listed.

6917 **Notes on residential fuel use: thermostat and window management.** Rosenfeld, A.H. (Lawrence Berkeley Lab., CA). *Energy Build.;* **1**: No. 1, 99-101(May 1977).

The computer model used shows that night temperature setback to 60°F in homes saves up to 30% of fuel in warm climates. In commercial buildings night/weekend setback to 50 or 40°F saves 0.33 to 0.5 the fuel. Permanent reflective film, e.g., Scotchtint, reflects valuable winter heat. If used as a shade, managed to admit winter sunlight, 25% fuel savings can be achieved.

6918 **Energy management.** O'Callaghan, P.W.; Probert, S.D. (Cranfield Inst of Technol, Bedford, Engl). *Appl. Energy;* **3**: No. 2, 127-138(Apr 1977).

Systematic procedures for energy management and audit of processes and products are suggested. They involve energy flow charts and assessment questionnaires and thereby facilitate the location, and reduction or elimination, of energy profligate subsystems. Design rules for the improvement of energy flow systems are listed. 5 refs.

6919 **Coming age of conservation.** Socolow, R.H. (Princeton Univ., NJ). *Annu. Rev. Energy;* **2**: 239-289(1977).

Article prepared during author's leave at the Energy Research Group, Cavendish Laboratory, University of Cambridge, England, during 1976 and 1977.

The energy dilemma for the most industrialized societies is usually perceived in terms of creation of an energy supply sufficient to permit expansion of consumption. The author, and many others, have been arguing that the energy dilemma would be as well formulated with inverted emphasis. Technology plays a dominant role in finding ways to make an industrialized society dynamic and high-spirited under the constraint of putting ever fewer demands on natural resources. Several themes emerge in this review: (1) in every sector of the economy, dramatic reductions in energy consumed to provide a given product or amenity are technically feasible; (2) however savings are computed, no single sector and no single strategy dominates the sum; and (3) the structures of the economies of the industrialized countries, viewed from the standpoint of energy consumption, are remarkably similar, such that when one of these countries identifies significant areas for energy conservation and promising tactics, these are almost always applicable in nearly every other country. This review suggests many of the characteristics of a society preoccupied with conservation; it is not a boring place. There is a lot of currently unfamiliar engineering: machines are more complicated, but built to be serviced and to last. There are large "extension" services, helping people and industries use resources more carefully. There are many jobs associated with the extension services and with doing repairs generally. Everywhere there is evidence of "systems" thinking: fewer energy-costly traffic jams, more thermally integrated industries, and a lot of tricks to match loads to requirements over time. 5 tables, 6 figures, 78 references.

6920 **Fuels, furnaces, and refractories.** Gilchrist, J.D. New York; Pergamon Press (1977). 366p. .

A concise account of the sources of energy available to modern industry and how this energy can most efficiently be used are discussed. Subjects covered in Part I, Fuels, include classification; properties and tests; coal; carbonization; coke; gaseous fuels; liquid fuels; electrical energy; and trends in fuel utilization. In Part

II, Furnaces: evolution of heat; combustion of fuel; conversion of electrical energy to heat; heat transfer; thermal efficiency; furnace aerodynamics; furnace construction; furnace classification; and laboratory furnaces are discussed. Following discussions on classification, properties, testing, and manufacture of refractories, Part III continues with sections on alumino-silicate refractories, silica bricks, magnesite-chromite refractories, carbon, and insulating and special refractories. Part IV, Instrumentation is devoted to pyrometry and control. (MCW)

6921 California energy trends and choices. Volume III. Opportunities for energy conservation. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 188p. (NP—22638/3).

The volume consists of a summary, the rationale for conservation, general strategies, adopted conservation policies, and existing and proposed programs in the public and private sectors. Potential future directions for energy conservation policy and programs are outlined. Recommendations for action and discussions of cost-effectiveness for most programs are included. Derivations of all the numerical values presented are given in the appendices. (MCW)

6922 State of Georgia energy conservation plan. Atlanta; Georgia Office of Energy Resources (1977). 344p. (NP—22604).

Georgia's Energy Conservation Plan entails measures that are cost-effective, practical, and supportive of existing State programs, particularly those that conserve energy. The Plan is also designed to meet the minimum requirements for funding under both the Energy Policy and Conservation Act of 1975 and the Energy Conservation and Production Act of 1976, in that it includes all necessary mandatory measures and projects at least a 5% reduction in 1980 energy consumption. This report contains formal application for EPCA funds only. The programs and their management plans, with specifics in each sector, are described. (MCW)

6923 Design guidelines for energy-conserving systems. Baker, M. Jr. New York; New York, Inc., Consulting Engineers (1977). vp. (NP—22647). Administration, Washington, DC.

Guidelines for the design of new Veteran Administration facilities are presented. The information given is applicable, in whole or in part to the following: solar energy systems, total energy systems, continuous-duty standby systems, engine-driven chillers/heat pump systems, and solid-waste boiler systems. The guidelines provide uniformity of design for new VA facilities and supplement established VA standards and policy. (MCW)

6924 Vanpool discussion paper. Pratsch, L. Washington, DC; Federal Energy Administration (1977). 15p. (NP—22373).

Commuter vanpooling, loved by the commuters using it, praised by employers sponsoring it, and endorsed by government agencies wishing to expand it, has achieved significant progress in the past few years. However, to accelerate its growth and maximize its contribution to reduced energy consumption, air pollution, and traffic congestion will require a concentrated effort to remove existing barriers to vanpools. In 1976 significant progress was achieved in establishing reasonably priced vanpool insurance. But, questions still remain such as: (1) should Workmen's Compensation cover or not cover vanpools; (2) should a commuter be allowed to make money carrying fellow commuters to work in a vanpool or should the "no-profit allowed" philosophy/regulations prevail, stifling the incentive of a driver to buy an $8,000 van and provide low-cost transportation to riders. It is the author's strong belief that certain actions must be taken at the national level to advance the vanpooling concept. There will be a number of opportunities to submit comprehensive vanpool energy conservation legislation, if it is available and widely supported. This overview is intended to present the issues and some options.

6925 State energy conservation plan report. Edgerton, R.H. Rochester, MI; Oakland University (1977). 20p. (NP—22414).

Implementation of energy conservation measures in Michigan must be based on certain premises in regard to energy resource availability. The most immediate energy problem is the shortage of natural gas. Further in the future a petroleum shortage or supply restraint may become critical. Coal is expected to be available as a substitute for both of these in the longer term. Nuclear fuels are available at present but their conservation is based on the need to extend the supply through development of commercial breeder reactors. It is not energy per se that is in short supply. It is the shortage or high price of certain selected fuels that are of concern. While energy conservation is a generally desirable approach to solving long-term problems, the immediate program should be directed at the 1977-1985 time period to allow time for the development of alternative sources. It is suggested that a goal should be the investment of energy conservation monetary savings in renewable energy conversion systems to provide a multiplier effect. This report attempts to critique the listing of state energy plan suggestions with additional suggestions. To choose the best strategy for a state plan, a system analysis should be made beginning with the development of a set of criteria by the state energy office. Suggestions on utilities, in industry, on education, in the commercial/residential sector, in the transportation sector, and in state government are examined.

6926 War on waste. Riverdale, MD; National Asphalt Pavement Association (1976). 20p. (NP—22206).

The National Asphalt Pavement Association (NAPA) believes that the government must assure its citizens that a petroleum predicament does exist and that the condition does not result from a fabrication or mismanagement by the oil companies or the mismanagement of government. After thoroughly reviewing the problem, NAPA presents some options--solar energy conversion into electrical energy, that electrical energy into chemical energy, then the development of hydrogen gas; development of geothermal and wind energy; utilization and conversion of coal; shale oil conversion; development of wood alcohol (methanol) and methane gas; nuclear fusion; and energy development from sea water temperature gradients, surf action, and tidal action. Their recommendations are described, but NAPA believes most of the potential solutions lie in the field of conservation, most probably, mandatory conservation. They specify governmental policies regarding a "war on waste". (MCW)

6927 Energy conservation: the Government's reply to the first report from the Select Committee on Science and Technology, Session 1974—1975, H.C. 487. London; Her Majesty's Stationery Office (1976). 17p. £ net.

The report from the committee covered the following: organization, industry, buildings, transport, public sector saving, information and motivation, wider energy issues, and legislation. The Government's reply in each of these areas is presented in this monograph. A number of areas on which the program should concentrate in its next phase are set out.

SUPPLY, DEMAND, AND FORECASTING

REFER ALSO TO CITATION(S) 5882, 5991, 6019, 6846, 6849, 6851, 6852, 6853, 6854, 6862, 6863, 6884, 6887, 6946, 6948, 6949, 6975, 6977

6928 (BNL—50685) Multi-objective function analysis of ERDA Forecast-2, year-2000 scenario. Cherniavsky, E.A.; Kydes, A.S.; Davidoff, J.W. (Brookhaven National Lab., Upton, N.Y. (USA)). May 1977. Contract EY-76-C-02-0016. 41p. Dep. NTIS, PC A03/MF A01.

Multi-objective function analysis was performed on the ERDA Forecast 2 Year 2000 Scenario using the Brookhaven Energy System Optimization Model. Trade-offs between several pairs of alternate objective functions were investigated, including oil imports vs capital investment, environmental index vs total cost, and oil imports vs environmental index. A best case was selected. Cost minimization is only one of many possible objectives in energy system optimization; trade-off analyses as described here incorporate other criteria.

6929 (ORNL/CON—13) Residential energy use to the year 2000: conservation and economics. Hirst, E.; Carney, J. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 62p. Dep. NTIS, PC A04/MF A01.

This report evaluates the energy and direct economic effects of implementing various residential energy conservation programs. These evaluations are conducted using a detailed engineering-economic model that simulates residential energy use on an annual basis for 1970 through 2000. These programs include several authorized by the 94th Congress and expanded upon by the present administration: appliance-efficiency standards, thermal standards for construction of new residences and weatherization of existing housing units. In addition to these Federal programs that are being (or will be) implemented in some form, we consider two additional measures to save energy: large fuel-price increases and elimination of all market imperfections associated with production and purchase of new equipment and homes. Altogether, nine different residential energy "futures" are considered. The highest projection, which assumes constant real fuel prices from 1976-2000, shows residential energy use growing from 16 QBtu in 1976 to 28 QBtu in 2000, with an average annual growth rate of 2.3 percent. The baseline, which assumes rising fuel prices, yields an energy use estimate of 24 QBtu in 2000. Implementing all the Federal programs listed above would cut energy use in 2000 by 11 percent, to 22 QBtu. Adopting these programs also reduces energy-related costs to households by $27 billion. Raising fuel prices by 50 percent after 1984 and eliminating all market imperfections yields essentially zero energy growth in the residential sector. However, the cost to households of higher fuel prices amounts to about $60 billion.

6930 (ORNL/EIS—101) Survey of state views on energy development in the Eastern United States for 1975, 1985, and 2000. Ross,

R.H.; Lewis, E.B. (Oak Ridge National Lab., Tenn. (USA)). Aug 1977. Contract W-7405-ENG-26. vp. Dep. NTIS, PC A06/MF A01.

Emerging energy technologies are expected to make a contribution to the future energy needs of the United States. However, in the eastern United States, this contribution will probably be minimal until sometime around the year 2000 when several coal conversion plants should be in operation. Other emerging technologies such as solar, geothermal, and bioconversion are not expected to make a significant contribution toward meeting the energy needs of the eastern United States by 2000. Coal combustion will continue to play an important role in electric power generation, and nuclear-generated power should become a more significant source of electricity as more units are expected to go on-line. Water quality is not seen as a limiting factor for energy development in the eastern United States, and water availability does not present a serious problem because of the number of major water systems. The information on which this report is based represents the views of the states considered.

6931 Two-stage forecasting methodology for developing a national energy policy. Murray, T.J.; Omurtag, Y. (Univ of Mo, St. Louis). *Energy Commun.;* **3**: No. 4, 407-427(1977).

This paper approaches the general problem of energy forecasting on a national level. Although numerous models are available and have been used, it is argued that any selected model is necessarily inadequate. After a review of the more commonly used forecasting techniques, a two-stage forecasting methodology is proposed. The first stage is "traditional" and utilizes multiple models; the second stage attempts to integrate the information provided by the first stage models into a coherent, maximally challenged forecast. 24 refs.

6932 Global energy system. Haefele, W.; Sassin, W. (International Inst. for Applied Systems Analysis, Laxenburg, Austria). *Annu. Rev. Energy;* **2**: 1-30(1977).

The authors concentrate here on the more persistent trends—the long-term trends. Starting their analysis around the middle of the nineteenth century, they observe that the energy system has evolved as a consequence of the deployment of technology, although its roots reach even farther back into history. Until around 1950, energy systems were primarily local. Although in some cases they crossed national boundaries, and some international trade in energy was carried on, the general economic mechanism was local, rather than global. During the past two decades, however, energy really assumed the dimensions of a global system. Perhaps, in retrospect, one can say that only since the oil embargo of 1973—1974 has it been clearly understood that energy represents a global system in its own right. It is not too surprising that energy has become an issue of such great public concern recently, since most of the general, international issues of tomorrow have important energy facets. Among these issues are world population growth, the processes of global economic development and urbanization, and the implications of modern technology for society. These issues—and others—shape the environment into which the global energy system of the future must be projected. It is with this environment in mind that this review attempts to structure and quantify the global energy system. A global energy system means an energy future evolving into the terawatt domain. The authors point out that the problems here are not so much technological hardware elements—we have learned to master these; rather, they concern institutions and the soft aspect of complex management and decision making—licensing, regulations, and standard setting. 23 figures, 23 references, 7 tables.

6933 Perspectives on energy in the People's Republic of China. Smil, V. (Univ. of Manitoba, Winnipeg); Woodard, K. *Annu. Rev. Energy;* **2**: 307-342(1977).

Study of the Chinese energy situation poses a difficult task. No systematic statistics have been published by the Chinese since 1960; reliance on newspaper articles, various news agency releases, radio broadcasts, occasional specialized publications, and bits of information brought out by visitors does not enable energy analyses and forecasts comparable to those available for developed nations and for other major developing countries (India, Brazil, Mexico). The rather infrequent past analyses of Chinese energy development—comprehensive or sectoral—have been recently augmented by studies benefitting from an increased flow of information from the People's Republic of China; but it is still a difficult, frustrating, and risky task to offer a reasonably reliable image of China's energy system. This review, within these constraints, presents the information available on the following: energy resources; fossil-fuel production and power generation; energy consumption; modern energy technology; intermediate-scale energy technology; foreign trade in energy commodities; foreign trade in energy production equipment; the continental shelf controversy; and China's future energy balance. 6 tables, 4 figures, 67 references.

6934 Perspectives on energy in India. Ramachandran, A.; Gururaja, J. (Technology Bhavan, New Delhi). *Annu. Rev. Energy;* **2**: 365-386(1977).

Views expressed are those of authors and are not necessarily those of the government of India.

The authors attempt to place India's energy problems in the perspective of the country's geographic location and its technological base. They are concerned primarily with patterns of energy consumption, the fuels or other sources required to produce this energy, and the effect that energy use will have on India's economic development. The overall situation is examined, and both the short-term problems and the long-term outlook are discussed. Considerable attention is devoted to questions of conventional energy supplies and new energy technologies that will fit into the Indian scene. A great deal must be done to translate energy plans into concrete and specific programs of action. The basic necessities such as food, clothing, and shelter for India's population, estimated to reach 950 million by the year 2000, can only be achieved with increased production requiring substantial growth of per capita energy consumption from present levels. In the context of India's needs, this undoubtedly is an immense task and one has to view energy resources, development, utilization, and conservation as part of a total system comprising urban and rural life styles—agricultural, industrial, transportation, housing, and domestic needs of the society. New techniques will have to be developed and utilized optimally at several levels in various sectors of the nation. Energy conservation and efficient use of existing energy sources must be more vigorously pursued. Fusion energy and solar energy are twin challenges for meeting future energy demands. The outlook for new energy sources is quite bright, but they must be developed with the aim of supplementing the conventional sources rather than displacing them. The challenges are very great, as are the rewards. 7 tables, 5 figures, 9 references.

6935 Perspectives on energy in Japan. Matsui, K.I. (Inst. of Energy Economics, Tokyo). *Annu. Rev. Energy;* **2**: 387-397(1977).

Views expressed are the author's and do not necessarily reflect those of the Institute of Energy Economics.

In fiscal year 1975, while the gross national product (GNP) of Japan increased by 3.1% to 93.1 x 10^{12} yen (in constant 1970 yen), energy demand decreased by about 5% to 367 x 10^{13} kcal. This was brought about by the overall effects of the high price of energy, a short-term conservation effort, and a relatively larger slump of activity in the energy-intensive industrial sector. Also the rapid growth of energy demand in the residential and commercial sector in the past was suppressed by the sudden price hike of secondary sources of energy and by the effect of several governmental measures intended to reduce energy demand during the crisis period. Payments for imported oil have increased by 12.9 billion dollars from 1973 to 1974. On the other hand, the value of exports from Japan to the oil-producing countries has increased by only 2.7 billion dollars during the same period. The difference corresponds to 2.3% of the GNP. Taking into account the multiplier factor, this transfer would result in the reduction of total demand of about 2% in 1974 and 3% in 1975. The oil crisis has brought a realization that the price of oil might either remain around the present high level or increase further in the longer term, and that world oil production will reach a peak and start to decline some time between 1985 and 1995. Also it seems more certain that the world oil supply will be more subject to political influence than in the past. In this situation, to foresee the future of the world economy and hence the Japanese economy becomes very difficult. Thus, the mid- and long-range perspective outlined here is more of a hypothesis than a forecast in the present, very uncertain, situation. 5 tables.

6936 Perspectives on energy in Sweden. Hambraeus, G.; Stillesjo, S. (Royal Swedish Academy of Engineering Sciences, Stockholm). *Annu. Rev. Energy;* **2**: 417-453(1977).

For a neutralist country like Sweden, maintaining a secure energy supply is very important. Both the geographic localization and the structure of industry must in some way depend on the distribution and availability of energy. The Swedish policy of striving toward a more equal distribution of income and wealth also depends on the maintenance of an adequate energy supply. Safeguarding the environment and human health is also a factor in energy production. With regard to the potential for reducing energy consumption, several methods for regulating use are mentioned. Studies are needed on the price elasticity of energy as a basis for eventual taxation or increased prices. Several noneconomic regulators, such as standards and laws, institutional factors, and environmental restrictions, will probably be used in the future. Government permits to establish new industries are granted only after consideration of factors such as capital, employment, and export/import balance. In 1977 the energy efficiency of new industries became an additional factor in the issuance of permits. Still other possibilities for regulating energy consumption are rationing or restrictions. Before such measures are introduced, however, it is essential to measure their effects, secondary as well as primary. There is a growing body of analysis of the earth's energy resources to the end of this century and beyond. These must of necessity form the basis for judgment in Sweden of what possibilities are open to our country

to go on consuming and producing energy. In the review, sections are devoted to: energy supply; energy storage; energy and the environment; shaping a national energy policy; the energy conservation program; and research and development. 18 tables, 7 figures, 46 references.

6937 Weather, gas, and solar heating: crisis and resolution. New York; Scientists' Institute for Public Information (1977). 36p. (CONF-770240—).

From Congressional seminar on weather, gas and solar heating) crisis and resolution; New York, New York, USA (17 Feb 1977).

The seminar was conducted to expose the urgency and need for an energy policy. Alan McGowan, President of Scientists' Institute for Public Information, expressed a view that due to the lack of an energy policy, persons suffered in the winter of 1977, particularly due to natural gas shortages. Then the solar aspect of the built environment and of heating systems was addressed. Panelists correlating these views were Roberta Hornig; Scott Bush; Dr. J. Murray Mitchell; Dr. Gerald E. Bennington; Joseph C. Dawson; and Wilson Clark.Questions posed by the audience were answered. (MCW)

6938 Energy: regional goals and the national interest. Mitchell, E.J. (ed.). Washington, DC; American Enterprise Institute for Public Policy Research (1976). 110p. (CONF-7510176—). .

From Conference on energy) regional goals and the national interest; Washington, District of Columbia, USA (2 Oct 1975).

In the foreword by Melvin R. Laird, he cites two lessons learned from the conference participants--that there can be no unique regional approach to the national energy problem and that the energy problem is now largely one of political statesmanship. Following an introductory speech by Michael Dukakis in Part One, The Economics of Regional Interests in Energy, three additional papers were presented. They are: The Impact of Alternative Regulation Policies, Milton Russell; Regionalism and the Public Interest in Energy, Charles Murphy; and The Energy Concerns of New England, Jill Schuker. Part Two consists of a paper, Energy Self-Sufficiency for the United States: The Energy Corporation, by Nelson A. Rockefeller. Part Three, Producers and Consumers, consists of a paper, The Politics of Reconciliation Between Producer and Consumer Interests by Pete V. Domenici and a Commentary on the subject by Jim Langdon and Jim Bishop. Part Four was a round table discussion on Energy Policy: A New War Between the States. (MCW)

6939 Perspectives on short-term energy shortages in the Netherlands. Lesuis, P.J.J.; Muller, F. (Erasmus Univ., Rotterdam). pp 104-118 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

An interregional input-output model used to measure the direct effects of the 1973 Arab oil boycott on production in the Netherlands and studies of the impact of short-term shortages on employment and balance of payments indicate the need for energy policies to reduce the growth of energy consumption. Economizing and optimization are demonstrated to be the only way to overcome the consequences of reduced oil supply when there is no opportunity to substitute alternative fuels. A breakdown is given of the production changes in each sector and the effect declining production had on balance of payments, income, and employment opportunities. A coexistence of scarcity and affluence indicates the need for allocation and distribution policies. 8 tables, 9 references. (DCK)

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 6141, 6846, 6849, 6881, 6887, 6888, 6894, 6895, 6912, 6921, 6930, 6931, 6933, 6936, 6938, 6953, 6967, 6970, 6973, 6980

6940 (NP—22456) **Analysis of the proposed National Energy Plan.** (Office of Technology Assessment (U.S. Congress), Washington, D.C.). Aug 1977. 145p. GPO $4.00.

The report begins with an executive summary, including the major conclusions on supply, demand, and societal impacts. Chapter II provides an overall perspective on the Plan and its policy implications. There follow chapters for each of the three impact areas and the issues that need to be considered. Finally, there are two appendixes: the first measures the magnitude of the energy problem; the second analyzes the effect of energy price changes on the supply of fossil fuels.

6941 (NP—22608) **Energy Research and Development Administration's national energy plan.** Commoner, B. (Washington Univ., St. Louis, Mo. (USA). Center for the Biology of Natural Systems). 29 Jul 1976. 52p. TIC.

Testimony before the Subcommittee on Energy Research and Water Resources of the U.S. Senate Committee on Interior and Insular Affairs hearings, Washington, DC.

After Barry Commoner reviews and criticizes ERDA's National Energy Plan, he concludes that the nation faces a transition from the present pattern of energy production and use to one which can provide an adequate, environmentally acceptable, supply of energy at a stable price. Otherwise, he says, we will be faced with escalating inflation, massive obsolescence of capital goods, and the serious economic disruption—rising prices, unemployment, dislocation of regional economics—that will inevitably follow. Enen so, the need will exist to curtail the production of energy-intensive pynthetic materials for which natural replacements are available. He then discusses the legislative procedures necessary to arrive at a rational effective energy policy. (MCW)

6942 Economic and technological models for evaluation of energy policy. Hoffman, K.C. (Brookhaven National Lab., Upton, NY); Jorgenson, D.W. *Bell J. Econ.;* **8**: No. 2, 444-466(Aut 1977).

Models for energy policy assessment have been developed using both process analysis and econometrics. The process approach provides for the incorporation of information on future technological and structural changes based on detailed engineering studies. The econometric approach is well adapted to the description of aggregative consumer behavior and economic activity. This paper presents a new approach for policy assessment, integrating process analysis and econometric models that have been used extensively in energy policy analysis and technology assessment. The application of this approach is illustrated by an analysis of a national research, development, and demonstration plan for the U.S.

6943 Energy supply, price hinge on high court rulings. Byrne, J.A. *Energy User News;* **2**: No. 37, 5(19 Sep 1977).

U.S. Supreme Court rulings were expected in October on cases dealing with licensing nuclear generating and reprocessing plants that will impact the future supply and price of energy. A decision on reprocessing, considered essential by the industry and utility and too hazardous by environmentalists, will affect future uranium supplies. The Court would also review a lower-court decision requiring environmental impact statements on nuclear wastes and more stringent licensing requirements that could delay future use of nuclear power in the country. A third case, not yet accepted by the court, could halt all nuclear power plant construction by ruling the Price-Anderson Act to be unconstitutional. Other cases to come during the new court term will determine the Environmental Protection Agency's authority to set air pollution standards, gas producers' right to re-direct gas, a state's right to limit access of supertankers to its ports, and a state's right to set intrastate gas rates. A brief description and possible implications are given for each of these cases. (DCK)

6944 Regulatory reform: alive and well and growing stronger in the 95th Congress. Levitas, E.H. *Prof. Eng. [a] Wash., D.C.;* **47**: No. 3, 26-29(Mar 1977).

The Administrative Rule Making Reform Act, sponsored by Rep. Levitas in the 94th Congress, provides for the congressional veto of administrative rules and regulations; while not, enacted, the act had strong support. Because of this support, on ten separate occasions, Congressional veto provisions were adopted on the House floor for various pieces of regulatory legislation in the form of the so-called Levitas amendment, so routine that they were often adopted in the House of Representatives by voice vote. The pieces of regulatory legislation that were amended to provide for Congressional veto included: Environmental Protection Agency Authorization Act; Federal Water Pollution Control Act Amendments; Federal Insecticide, Fungicide, and Rodenticide Act Extension; Toxic Substances Control Act; and Clean Air Act Amendments. (MCW)

6945 Supplementary statements on National energy policy and planning. Washington, DC; Systems Consultants Inc. (1977). 2p. (NP—22166).

The nation's future is dependent on the availability and cost of raw materials, including energy, as well as labor and capital. A key factor is improved energy system efficiency. Therefore, the management and staff of Systems Consultants, Inc. respectfully suggest that President Carter give added consideration to the integration of the following into our National Energy Goals: (1) improved energy system efficiency as it relates to utilization of energy--in the areas of urban/suburban design and developments, industrial production concepts and their applications, and transportation systems for goods and services; (2) improved energy extraction as it relates to renewable and depletable energy including fossil, solar, and nuclear sources; (3) improved energy application as it relates to the direct conversion of energy materials into useful forms such as electricity and heat; and (4) increased attention to near- and longer-term research and technology that is the basis for the design, development and broad application of the knowledge and techniques critical to enhanced energy productivity, conservation of limited energy materials, and social/economic system viability and growth.

6946 European Community: an energy perspective. Brondel, G.; Morton, N. (Commission of the European Communities, Brussels). *Annu. Rev. Energy;* 2: 343-364(1977).

Expresses personal views of the authors and not necessarily those of the Commission of the European Communities.

The main principles of energy policy the Community wishes to follow are, namely: (a) reduce its total demand for energy as far as possible; (b) switch final demand for energy into some fuels and away from others; (c) increase production from indigenous sources of energy, and, to the extent that these are successfully accomplished; and (d) reduce its dependence on imported sources of energy. In implementing this policy, the Community both by its own efforts and by exhorting the Member States to carry out Community policy, will need to have regard to the internal and external aspects of the energy systems of member nations. Internally, 1977 was to be spent consolidating certain parts of the work program already adopted; the following parts are of outstanding importance: (1) vigorous implementation of measures for the rational use of energy; (2) reexamination of objectives, including objectives for 1990; (3) protection and promotion of investments; (4) promotion of use of coal in power stations, and cyclical stockpiling of coal; (5) oil-refining capacity; surplus distillation capacity; compatibility with structure of product demand; (6) imports of refined petroleum products; (7) oil stocks, their location and financing; (8) support for hydrocarbon research and exploration projects; and (9) solving problems of nuclear fuel supply. At the same time, it is hoped that Member States will, where applicable, vigorously pursue their nuclear electricity construction programs and their plans for production of oil and natural gas. Nevertheless, when all possible efforts have been made on internal policies, the Community remains, in any of a range of plausible scenarios, heavily dependent on imported oil and gas for about 50% or more of its total energy needs.

6947 Middle East: U.S. policy, Israel, oil and the Arabs. Washington, DC; Congressional Quarterly (1977). 205p. .

This book provides an up-to-date, in-depth analysis of the issues and disputes involving the countries of the Middle East. Emphasis is upon United States involvement in the entire region, historically and at present. This Third Edition covers the dramatic events which have been shaping political and economic realities throughout the area. The controversial Palestinian question, the tragic events of the Lebanese civil war, the continuing debate about the future of the Israeli-occupied territories, the Carter adminisration's evolving Middle East policies, and the issues surrounding Middle East oil are all highlighted. Background information contained in the previous two editions, published in 1974 and 1975, has been incorporated. Part I contains country-by-country profiles and a chapter on Arab history. Part II provides analyses of the major issues affecting Middle East political and economic life: Middle East diplomacy, U.S. Middle East policy, Middle East oil, the Palestinian problem, chapters on the Arab and Israeli lobbies in Washington, and a background chapter on the Arab-Israeli wars during the past three decades. Part III is an appendix containing biographies of leading figures from Middle East history during the 20th century, a detailed chronology covering major Middle East events from 1945 through August 1977, and a comprehensive bibliography noting books, articles, reference sources, and Congressional documents.

6948 California energy trends and choices. Volume I. Toward a California energy strategy: policy overview. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 228p. (NP—22638/1).

This volume sets forth the view of energy policy and its long-term implications in the hope that the public will be provided the impetus to take action. In the introductory chapter, the failure of the Federal energy policy and the imminence of resource scarcity are discussed. The following chapters cover a history of energy use in California; an extrapolation of present trends into the future; three basic views about what energy policy should be, i.e., views held that are rooted in different conceptions of the impact of resource scarcity and how it should be dealt with; and finally, the State Energy Commission proposes a synthesized, practical set of policies that will lead to incremental improvements in the status quo. (MCW)

6949 California energy trends and choices. Summary. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 281p. (NP—22638(Summ.)).

The summary report abstracts the key findings and policy recommendations of the State Energy Commission's Report to the Legislature and Governor. Seven volumes were prepared in response to the requirements of the Warren-Alquist Energy Conservation and Development Act. The reports reflect the fact that California has had a concerted effort underway for several years to promote energy conservation and a balance between supply and demand. The report also provides a California perspective on the energy, economic, and environmental issues concerning energy. (MCW)

6950 Formulation and implementation of a community energy policy. *Bull. Eur. Communities;* No. 12, 62-65(1976).

Formulation and implementation of a European Community energy policy were undertaken at the meeting in December, 1976. The European Council examined measures to be taken in the event of difficulties in oil supply, uranium prospecting, and questions linked with coking coal and coke for the iron and steel industry. In the main in 1977, the Council was expected to take decisions on the following European Communities Commission proposals: rational utilization of energy, protection and promotion of investments, energy prices, incentives for the use of coal in power stations, aids for the storage of coal as a buffer against short-term economic movements, problems linked with excess refining capacity and protection of the refineries against imports from non-member countries, the problem of multilateral agreements on stocks built up on the territory of one Member State on behalf of undertakings established in other Member States and financing for emergency stocks, examination of national programs and Community objectives, nuclear fuel supplies and the fuel cycle, technological projects of Community interest in the hydrocarbons sector, and oil and gas prospecting. The Energy Committee meeting discussed procedures for examining national programs and specifically, some issues on hydrocarbons, coal, and electricity were examined. (MCW)

6951 United States energy policy: the record and some current options. Mead, W.J. Santa Barbara, CA; University of California (1976). 22p. (CONF-7606163—1).

From The Western Economic Association annual meeting; San Francisco, California, USA (24 Jun 1976).

The author broadly examines the major energy policy issues, namely: energy taxation, import quotas, price controls, energy resource conservation, oil transportation by tanker, oil storage for national security, and policies regarding competition. Mr. Mead points out that the survey of the government petroleum policy leads to dismal conclusions. He further concludes that new oil policies with respect to competition, transportation (extending the Jones Act plus enactment of a possible oil transport bill), and continued natural gas and crude oil price controls with allocations and entitlements promise only further distortion in resource allocation. 24 references. (MCW)

FOSSIL FUELS

REFER ALSO TO CITATION(S) 5890, 6886

6952 Uses of fossil carbon carriers of material and energy current status and outlook. Keil, G.; Grossmann, P.; Klare, H. (Akad der Wiss der DDR, Berlin, E Ger). *Energietechnik;* **27**: No. 1, 1-7(Jan 1977). (In German).

Reference is made to global energy consumption and presently known stores of fossil energy sources. Technical developments associated with the complex utilization of carbon-containing materials are discussed. Specific conditions for processing of brown coal into "noble" energy carriers that are prevalent in East Germany are described. 21 refs.

6953 California energy trends and choices. Volume IV. Fossil fuel supply issues. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 497p. (NP—22638/4).

Following an overview of the issues and summary recommendations (Part I) are discussions of LNG and LPG (Part II), the Elk Hills Naval Petroleum Reserves (Part III), North American crude oil and natural gas supply and transportation (Part IV), and offshore oil and gas development (Part V). The State Energy Commission plans to expand its study of fossil fuels to include demand issues, the potential use of coal and other alternate fuels in the state, and the environmental effects of fossil fuel utilization. (MCW)

COAL

REFER ALSO TO CITATION(S) 5784, 5830, 5882, 5884

6954 Coal option: constraints to growth. Issues, impacts, solutions. Gambs, G.C. New York; Ford, Bacon and Davis, Inc. (1977). 41p. (CONF-770370—1).

From Conference of the financial analysts; Wilmington, Delaware, USA (16 Mar 1977).

The author states emphatically that the U.S. is in danger of being destroyed due to its lack of action to develop our domestic supplies of oil, gas, and coal. The inaction could result in the collapse of the U.S. as an industrial nation. Seven actions that must be taken now to prevent catastrophic effects are suggested, namely: (1) decontrol prices for new natural gas; (2) decontrol prices for all crude oil; (3) amend the Clean Air Act to allow burning of high-sulfur coal through use of intermittent control systems; (4) remove obstacles to mining of coal through amendments to the Federal Mine

Safety Act and Federal Coal Leasing Act; (5) remove obstacles to the construction of nuclear power plants; (6) pass legislation to provide for the incentive for energy conservation such as 100% depreciation on the first year for installation of coal-fired boilers and energy-conservation equipment by industry and similar tax incentives to home owners for installing insulation, etc.; and (7) pass legislation to provide for $1.00 per gallon tax on gasoline to encourage conservation of petroleum and tax revenue to be used for mass transportation and synthetic-fuel projects. (MCW)

6955 Appalachian coal and the Northeast: a framework for impact assessment. Gleason, E.J. Jr. Albany; Northeastern Legislative Energy Staff (1976). 10p. (CONF-761245—1).

From Northeastern workshop on technology assessment; Burlington, Vermont, USA (8 Dec 1976).

Some considerations dealing with increased coal usage, in terms of the Northeast, are summarized. Facts on U.S. energy challenges and the Northeast's energy problem are reviewed. For at least the past five years, the states of New England, New York, New Jersey, Pennsylvania, and Delaware combined have imported approximately 80% of their energy requirements. He goes on to discuss use of Appalachian coal as a policy option, its consumption constraints, present sulfur removal technology, its transportation choices, and production issues. He concludes that this option should be seriously considered along with other energy supply and conservation options available to the region for the next 5 to 25 years. (MCW)

6956 Markets and processes for synthetic fuels from coal. Executive summary. Gorham, ME; Gorham International Inc. (1976). 43p. (CONF-761186—(Summ.)).

From Conference on synfuels from coal; Hollywood, Florida, USA (7 Nov 1976).

This intensive conference was designed to bring together a group of business and governmental executives (all seriously interested in synthetic fuels from coal but with a variety of perspectives) to assess the current and future technological, economic, legislative, political, and environmental factors that will govern the extent to which the U.S. can achieve energy self-sufficiency through the use of synthetic fuels from coal. Senator Jennings Randolph presented a stimulating keynote address that stressed the necessity for the Federal government and entire population of the United States to work together to achieve energy self-sufficiency through the use of coal, our most abundant fuel resource. Note: only summarized highlights are included; the only full-length paper included is the keynote address of Sen. Randolph. (MCW)

PETROLEUM

REFER ALSO TO CITATION(S) 5887, 5888, 5971, 5976, 5979, 6852, 6856, 6928, 6947

6957 (PB—269948) Project Independence Evaluation System (PIES) documentation. Volume XI. Finance submodel for the FEA oil and gas supply model. (ICF, Inc., Washington, D.C. (USA)). Sep 1976. 64p. (FEA/N—76/421). NTIS.

The finance submodel produces industry-wide income statements for the oil- and gas-producing industries, which permit PIES results to be translated into detailed schedules of oil and gas industry capital requirements. This report describes the finance submodel in terms of its logic, input data, and output format.

6958 Organization of the Arab Petroleum Exporting Countries: objectives and potential. El Mallakh, R. (Univ. of Colorado, Boulder). *Annu. Rev. Energy;* **2**: 399-415(1977).

Established in 1968 by Kuwait, Saudi Arabia, and Libya, the Organization of the Arab Petroleum Exporting Countries (OAPEC) was preoccupied in its early years with efforts to increase its membership. Headquartered in Kuwait, OAPEC now also includes Algeria, Egypt, Syria, Qatar, Bahrain, Iraq, and the United Arab Emirates; only the Arab oil-exporting states of Tunisia and Oman remain outside the body. The timing of OAPEC's creation heavily influenced its direction and goals. In the wake of the June 1967 Middle East conflict, the Arab oil states individually reacted in diverse degrees through production slowdowns, stoppages, and ad hoc boycotts singularly marked by lack of coordination and success. The trends then underway toward expanding participation of producer governments and rising pressure for higher prices had not gathered the sweeping momentum evident by the opening of the 1970s. The initial impulse in fashioning the body was two-pronged: (a) to reduce the disarray in Arab policies through a formalized or institutionalized level of coordination, and (b) to provide a means of channeling "crisis aid" to Egypt, Jordan, and Syria. The prime goals of OAPEC have centered upon (1) promotion of coordination of petroleum policies with special emphasis on development; (2) promotion of exchange of information and coordination in training programs and research; and (3) actual establishment and operation of joint ventures in the field of hydrocarbons on a commercial scale, entailing formation of independent companies in which shares are held by member states. The importance of OAPEC to the U.S. and other members of OECD lies in the increasing level and direction of trade and economic interdependence between the two groups. 12 footnotes, 7 tables.

NATURAL GAS

REFER ALSO TO CITATION(S) 5887, 5888, 5984, 5991, 6937, 6957

6959 (CONF-761162—) Outlook for new sources of gas supply. (Institute of Gas Technology, Chicago, Ill. (USA)). 1976. 76p. of Gas Technology, Chicago, IL.

From 35. annual meeting of members and of the board of trustees of the Institute of Gas Technology; Chicago, Illinois, United States of America (USA) (17 Nov 1976).

Included are presentations from 5 speakers: Dr. William T. McCormick, Jr., Director, Office of Commericalization, ERDA; Dr. Vincent E. McKelvey, Director, U.S. Geological Survey; Dr. Gorman C. Smith, Ass't. Administrator for Regulatory Programs, FEA; Mr. J. Wade Watkins, Deputy Director, Division of Oil, Gas, and Shale Technology, ERDA; and Dr. Herman Enzer, Director, Office of Minerals Policy and Research Analysis, U.S. Dept. of the Interior. On completion of the presentations, the speakers were assembled as a panel for a group discussion, moderated by Dr. James J. Brophy, senior vice president, Institute of Gas Technology. There was a luncheon address by John H. Holloman III, Vice Chairman, Federal Power Commission. Dr. McCormick addressed the problem of replacing conventional supplies of gas with synthetic gas, arctic gas, LNG, etc. Dr. McKelvey discussed the possibilities of gas supplies in new offshore areas pointing out that 4.3 trillion ft^3 were produced on the continental shelf in 1975. Dr. Smith's presentation was concerned with the problems of total supply and distribution of available supplies, particularly the role of the FEA in getting gas out from under boilers where coal, and in some cases oil, can be substituted. Mr. Watkin's topic was Enhanced Onshore Recovery of Natural Gas, covering the following: tight formations, geopressured aquifers, coal beds, landfills, and gas hydrates. Dr. Enzer, who headed the Interior Department's study of alternate routes for delivery of Alaskan gas to the Lower 48 States, assessed the potential supply of Alaskan and Canadian Arctic gas. It was concluded that the potential for new sources of supply is there; improved technology is an issue, but not the dominant one. The dominant issue is to provide the consumer with a choice of energy sources; to do this, all potential sources of gas supply must be examined.

6960 (PB—269947) Project Independence Evaluation System (PIES) documentation. Volume X. Automation of finding rate and discount rates in the FEA gas supply model. (ICF, Inc., Washington, D.C. (USA)). Sep 1976. 41p. (FEA/N—76/420). NTIS.

The methodology used to automate, within the model, the straightforward but laborious calculation of finding rates and discount rates is described.

6961 Liquefied natural gas: moving energy from here. Higgins, K. (National Bureau of Standards, Boulder, CO). *Dimensions/NBS;* **61**: No. 5, 10-13(May 1977).

The National Bureau of Standards has been developing and improving methods for getting natural gas from producer to consumer in the liquefied form. LNG is important to the whole natural gas system because of the economics of transportation and storage. A major factor is the obvious advantage of transporting natural gas as LNG by ship to and from foreign countries where pipelines are not feasible or are impractical to construct. One way to reduce the effect of peak-demand conditions is to build LNG peak-shaving facilities, where distributors convert natural gas that is unused during times of low demand to LNG. The LNG is stored until peak-demand conditions arise. Then, when the daily allotment is consumed, the unused natural gas, stored as LNG, is converted back to natural gas and provided to the distributor's customers with no interruption. Today, peak-shaving facilities account for the largest use of LNG in the U.S. One hundred-six facilities are now in operation or being completed, (55 are actual liquefaction, storage, and gasification operations; 51 are satellite storage plants). Existing U.S. peak-shaving plants can now store 3 million cubic meters of LNG (65 billion cubic daily feet equivalent of natural gas) and produce approximately 14,000 cubic meters of LNG daily for storage. (MCW)

6962 Relationship between the price and demand for natural gas: a partially controlled study. Horowitz, C.E.; Mayer, L.S. (Univ. of Princeton, NJ). *Int. J. Energy Res.;* **1**: No. 2, 193-222(1977).

Natural gas prices have increased for most residential consumers since the onset of the energy crisis, precipitated by the Arab oil embargo. No short-term effects of price on demand are found when the relationship between price and monthly demand over five years is examined for a sample of nearly identical owner-occupied town houses in a central New Jersey planned community. It is

shown that, since the onset of the energy crisis, the average price, in current dollars, of gas has increased in the U.S. and the average demand has decreased, leading to an estimate of negative elasticity. This disappears when the effects of overall inflation on demand are removed. A closer examination reveals that the relationship between current price and demand is not linear, since the major decrease in demand occurred during the first winter following the embargo, but major increases in price occurred during subsequent winters. Still to be answered is the question of whether the large reduction in demand is due to price increases, overall inflation, or a response to conservation appeals by the government.

HYDROGEN AND SYNTHETIC FUELS

REFER ALSO TO CITATION(S) 6956, 7076

ELECTRIC POWER

REFER ALSO TO CITATION(S) 6873

6963 Energy centers: a report on Pennsylvania's experience. Ferrar, T.A.; Clemente, F. University Park, PA; Pennsylvania State University (1976). 7p. (NP—22499).

The article discusses the concept of energy parks in relation to proposals made in Pennsylvania regarding the construction of such complexes. It is relevant to other states that are also considering the concept of aggregated siting. As defined by the Energy Park Development Group (EPDG) in Pennsylvania, an energy park would be comprised of ten generating units at one site; five would be fossil and five would be nuclear. The EPDG made three points: first, the energy park alternative could minimize the environment, social, and private costs associated with electric-generating plants; secondly, these cost savings could be passed along to the consumer; and thirdly, an energy park could be more land-use efficient than the equivalent number of plants at dispersed sites. (MCW)

6964 Compared energy policies of France, Britain and Germany. II. Electricity and nuclear energy. de Carmoy, G. (INSEAD, Fontainebleau, Fr). *Rev. Energ.;* **28**: No. 294, 319-326(May 1977). (In French).

Part 2 of the article deals with the complex subject of electricity production in the three countries, using all primary sources of energy. Emphasis is placed on the prospects for the production of nuclear electricity.

6965 Possibility of using regression models to account for the effect of weather conditions on electric power demand. Shatalov, V.I.; Kopach, E.N. (Sib Sci Res Inst of Energet, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 5, 36-40(May 1977). (In Russian).

One of the methods of taking account of the effect of the complex of weather factors on the total electric power consumption in an electric power system is considered. An analysis of different regression models is carried out, depending on the type of input variables. Results of short-term forecasting with account being taken of weather conditions are presented.

6966 Structure of economic relations and specifics of business accounting stimulation in power industry. Albegova, L.I.; Romanov, A.P. *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 3, 116-119(Mar 1977). (In Russian).

The structure of the Soviet power industry is explained and the difficulties of applying business accounting stimulation to individual utility plants, owing to centralized control, are pointed out.

6967 California energy trends and choices. Volume II. Electricity forecasting and planning. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 182p. (NP—22638/2).

The overview (Chapter I) provides a general discussion of California's electrical energy issues and points of controversy specifically related to electricity demand forecasts and resource planning; major findings are summarized. Chapters that follow are: Estimates of Future Electricity Demand and Analysis of California Utility Forecasts, 1975 to 1995; Opportunities for Electricity Conservation in California; Analyses of Utility Supply Plans and Important Supply Planning Issues; Utility Reserves and Reliability; Assessment of the Potential Environmental Impacts; and Electricity Choices Ahead. (MCW)

6968 Staff report on projected 1977 Summer load-supply situation: contiguous United States. Washington, DC; Federal Power Commission (1977). 38p. (NP—22401).

This report summarizes data concerning projected peak loads and available power resources for the 1977 summer peak period as reported by electric utilities in each of the nine Regional Electric Reliability Council areas of the contiguous United States (covering approximately 98 percent of the total electric load). This study compares the estimated summer peak loads with the projected capability expected to be available by the end of May 1977. Actual generating reserves for individual systems may be higher than listed due to the fact that capacity additions for June, July, and August 1977, are not included in the reserve calculations but may actually be available for the summer peak depending on the date of occurrence of the summer peak. This study makes the conservative assumption that capability forecast as being unavailable because of scheduled maintenance or other reasons will be out of service at the time of the summer peak. The summer peak load responsibility for the lower 48 states is projected to be 400,043 megawatts, resulting in a reserve margin of 23.7 percent of the estimated summer responsibility.

6969 Use of ripple control with particular application to conditions in Zambia. Yodaiken, J. *Proc. Inst. Electr. Eng. [B London B];* **123**: No. 11, 1248-1251(Nov 1976).

The letter deals with the tariff structure peculiar to cities in Zambia and the effective use of load control on demand and cost. The tariff of charges applicable to the supply of the city of Ndola and other municipal authorities was a 2-part tariff consisting of a kVA demand charge based on a maximum demand created in any half hour of the tariff year. The unit charge plus a coal price adjustment clauses was also applicable. Cities with load factors of 35-39% found that the introduction of load-control equipment, using the ripple relay, resulted in load-factor improvement out of all proportion to the capital invested. Ndola City Council was, however, the first local authority to have a really sophisticated control system. The object of this paper is to indicate the importance, to the distribution engineer, of the development, by manufacturers and authorities, of equipment for use with load control which can ensure utilization of load-control equipment to the fullest.

6970 Forecasting alternative regional electric energy requirements and environmental impacts for Maryland, 1970—1990. Cumberland, J.H.; Donnelly, W.; Gibson, C.S. Jr.; Olson, C.E. (Univ. of Maryland, College Park). pp 32-57 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

A regional rather than national solution is needed for some of the difficult energy issues, such as power plant siting, which can cause localized economic, social, and envionmental hardship. Forecasts are made of Maryland electricity demand, the environmental impacts of meeting this demand, and the implications for decisions on specific power plant sites. There are seen to be many options open to local governments to control electricity demand growth by encouraging rate structures that favor energy conservation; taxing air, water, and land pollutants; and encouraging less energy-intensive activities. Local vetoes of state projects can be a useful way to develop less-damaging projects while lessening conflict between state and local governments. Good planning for peak-load pricing and service expansion can avoid supply interruptions and still promote the kinds of economic development that are socially beneficial without causing excessive damage to the environment. 12 references, 15 tables. (DCK)

6971 Dynamic regional analysis of factors affecting the electrical energy sector in the U.S. Pachauri, R.K. (Federal Energy Administration, Washington, DC). pp 90-103 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

An econometric model was designed to analyze the growth of electrical energy in a specific region in southeast U.S., emphasizing formulation and estimation of relationships representing electrical energy demand. A projected demand increase of 111.10 percent by 1990 will result in a slowdown in demand growth, since southeast utilities are expected to increase by 185.26 percent. Changes in electricity rates will have the greatest impact on the residential sector. Although the commercial sector will be only slightly affected by price changes, all sectors are sensitive to the region's economic growth. The model also indicates the southeast as one of the fastest growing regions. When seasonal variations of demand and price are introduced, it is indicated that pricing policies need to be careful not to exaggerate peaking effects. Decreasing block rates are found to reduce both demand for energy and capital. 3 figures, 22 references. (DCK)

ELECTRIC POWER GENERATION

REFER ALSO TO CITATION(S) 5784

6972 Economies of scale in electricity generation in the United Kingdom. Abdulkarim, A.J.; Lucas, N.J.D. (Imperial College of Science and Tech., London). *Int. J. Energy Res.;* **1**: No. 2, 223-231(1977).

The investment program of the Central Electricity Generating Board (CEGB) since the 1950s has been largely based on economies of scale, generally 500-MW turbine generator sets. The strategy adopted by CEGB is compared with alternative hypothetical strategies based on smaller units of plant. Simulation of the supply system over ten years suggests that economies of scale in very large plants were sufficient to offset the attendant disadvantages. Allowance is made for the variation with capacity of the capital cost, thermal efficiency, construction time, planning margin and availability. It is concluded that better results might have been obtained with 200- and 300-MW generator sets. This analysis is only indirectly connected with the decisions now facing the CEGB, because the potential economies of scale in nuclear stations differ from those in fossil-fuel plants. There is also some uncertainty about the validity of the conclusions. The analysis does show that there are conditions where economies of scale are outweighed by other factors, that these conditions are not especially remarkable, that they seem to have been satisfied by the CEGB system, and that supply utilities in developing countries, where comparable decisions must now be made, should carefully examine the case for large generating units in local situations. 13 references.

6973 California energy trends and choices. Volume VII. Power plant siting. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 73p. (NP—22638/7).

The report is prepared as required by the California Public Resources Code and State Energy Commission orders. The following are included in Chapter I of this report: a list, including maps, of existing electric generating sites; a list, including maps, of sites and potential multiple facility sites which have been found to be acceptable to the Public Resources Code; a selected list of those factors that might be considered in determining whether an area is either suitable or unsuitable for power plant siting and a discussion of how those factors might be used; and a list, including maps of possible areas that are appropriate for additional electrical generating sites. Chapter II deals with the constraints upon the selection of sites for power plants. (MCW)

CONSUMPTION AND UTILIZATION

REFER ALSO TO CITATION(S) 6120, 6277, 6847, 6865, 6871, 6885, 6902, 6909, 6917, 6920, 6934

6974 (AED-Conf—77-072-002) **Analysis of the application of energy demand in the West German chemical industry.** Anton, P.; Spanoudakis, C. (Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)). 1977. 2p. (In German). (CONF-770585—1). Dep. NTIS, PC A02/MF A01.

From Meeting on the application of energy at the final consumption stage - analysis, planning, techniques; Schliersee, F.R. Germany (17 May 1977).

A historical analysis of energy consumption in the West German chemical industry is briefly reviewed from the year 1950 and estimates are given to the year 2000.

6975 (BNL—23193) **Future patterns of energy utilization.** Hoffman, K.C. (Brookhaven National Lab., Upton, N.Y. (USA)). 1 Sep 1977. Contract EY-76-C-02-0016. 36p. (CONF-770956—1). Dep. NTIS, PC A03/MF A01.

From Energy workshop of the National Science Council of Ireland; Dublin, Ireland (13 Sep 1977).

Further economic and social development in developed and developing countries will require increased levels of energy services and energy-intensive goods. The level and forms of energy required to deliver these services is dependent on the structure of the economy, future lifestyles, and new technological developments. These relationships are explored, and estimates of future world energy demands to the year 2000 are surveyed. Specific attention is directed at the patterns of energy utilization considering the unique requirements for specific fuels and electric power in the household, industry, and transportation sectors. Resource production levels are estimated corresponding to the patterns of utilization.

6976 (NATO/CCMS—47) **Industrial international data base: the steel industry, pilot study. Final report.** (Gordian Associates, Inc., New York (USA)). 1977. Contract EX-76-C-10-3869. 58p. Dep. NTIS, PC A04/MF A01.

Report of Committee on the Challenges of Modern Society.

This report presents the results of a study of energy consumption and conservation in the iron and steel industries of seven countries: Belgium, France, Germany, Italy, Netherlands, United Kingdom, and United States. The overall objective of the study is to identify energy-efficient technologies and operating practices for iron and steel production which have a high potential for energy conservation. Benefits of this international cooperative study are to be developed on two time frames. The first are short-term benefits through the mechanism of technology transfer of existing energy-efficient technologies. The long-term benefits include recommendations for R and D and demonstration programs for projects requiring additional development before their energy-conserving potential can be realized. The 41 projects listed give an overview of energy-conservation technologies and techniques that could serve individual needs.

6977 Measurement and energy savings. Olmer, P. (Lab Cent des Ind Electr, Fr). *Rev. Gen. Electr.;* **86**: No. 1, 1-8(Jan 1977). (In French).

Some figures concerning the energy problem data in France are recalled, taking as reference the year 1973. The total French consumption of primary energy amounted to 265 Mtec (millions of tons of coal equivalent) which corresponds to an individual average consumption of 5.3 tec (13 tec in the USA). Of this consumption, 21.5% was used for electricity generation. Only 24% of the total consumption was covered by national production. Estimates of consumption for the year 2000 give the figure of 740 Mtec, of which hydrocarbons would constitute about 400 Mtec. The opportunities for energy savings in large, medium, and small companies are considered.

6978 Technical progress in agriculture and its implications for energy use. von Bremen, L. (Inst. fuer Landwirtschaftliche, Braunschweig, Ger.). pp 307-314 of In Energy, regional science and public policy. Chatterji, M.; Van Rompuy, P. (eds.). New York; Springer-Verlag (1976).

From International conference on regional science, energy and environment; Leuven, Belgium (22 May 1975).

See CONF-750554—.

Recent technical progress in agriculture has resulted in substantial substitutions in the numbers of workers, price relations, reduction of adjustment opportunities, and energy inputs. The growing dependence of agriculture on energy supplies will have an increasing political impact due to the interdependencies of food-producing and energy-producing nations. The energy input-output relation in the agricultural sector is higher in North America than in northwestern Europe largely because of the heavy use of fertilizers. Developing countries, on the other hand, have low inputs for both machinery fuel and fertilizer, although the potentially important use of plant nutrients and irrigation are not included in the study. Comparisons made of the energy needs of industrialized and developing countries for livestock and food processing indicate a similar high level of fossil-energy input. High prices give industrialized countries the advantage at present, but future food supply problems might be avoided by making adjustments in price relations and technological applications. 18 references. (DCK)

UNCONVENTIONAL SOURCES AND POWER GENERATION

REFER ALSO TO CITATION(S) 6894

6979 (CONF-770715—) **Inexhaustible energy resources study.** (Energy Research and Development Administration, Washington, D.C. (USA)). 1977. 54p. Dep. NTIS, PC A04/MF A01.

From 2. public meeting to review the status of the inexhaustible energy resources study; Washington, District of Columbia, United States of America (USA) (20 Jul 1977).

The purpose of the study is to: (1) answer the question of how soon the inexhaustibles are needed; (2) formulate strategies for development and deployment of the inexhaustibles; (3) identify alternative paths to utilization of these sources, followed by a purpose to serve as a guide to budget formulation; and (4) develop funding profiles associated with each strategy. Bennett Miller, the Executive Director of the study, reviewed activities of the Inexhaustible Energy Resources Study since the initial meeting was held. Then questions from the public were entertained and answered. (MCW)

6980 California energy trends and choices. Volume V. Status of alternative energy technologies. Sacramento, CA; Energy Resources Conservation and Development Commission (1977). 136p. (NP—22638/5).

Volume 5 is the first part of the State Energy Commission's report on its activities in research and development of both conventional and alternative sources of energy supply, energy demand, and energy conservation. It contains the policies and recommended actions for developing and implementing, in California, specific alternative technologies—solar energy, geothermal energy, fuels from coal and biomass, and fuel cells—and options for power plant

cooling. The appendix discusses other energy technologies the application of which in the state is now uncertain. (MCW)

6981 **New frontiers in solar and other energy options.** Abdel-Hameed, M.F.; El-Difrawi, A.A. (Northern Illinois Univ., Dekalb). pp 525-540 of In Heliotechnique and development. Volume II. Kettani, M.A.; Soussou, J.E. (eds.). Cambridge, MA; Development Analysis Associates, Inc. (1976).

From International conference on heliotechnique and development; Dhahran, Saudi Arabia (2 Nov 1975).

See CONF-7511131—P2.

The use of coal may continue for a few hundred years, and nuclear power may seem an attractive alternative, but there are serious problems especially with nuclear waste disposal. Non-polluting options such as solar energy and related approaches are the most logical candidates for future energy supply. Several new frontiers in solar technology are quite promising and these include: photosynthesis, synthetic leaf, hydrogen energy, wind power, artificial tornados, space colonization, and colonization of marginal habitats on earth.

SOLAR

REFER ALSO TO CITATION(S) 6118, 6120, 6121, 6122, 6140, 6141, 6142, 6144, 6145, 6277, 6280, 6297, 6304, 6677, 6918, 6937

6982 (AED-Conf—77-027-007) **Use of solar energy 1977: state of the art, experiences, and aspects.** Ante, B. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). 1977. 27p. (In German). (CONF-770378—7). Dep. NTIS (US Sales Only), PC AA02/MF A01.

From 3. meeting of the Deutsche Gesellschaft fuer Sonnenenergie e.V. on heating with sun 2 - house technology under practical aspects; Munich, F.R. Germany (3 Mar 1977).

Starting from a general survey of questions of energy policy and availability of energy, the author discusses energy sources that are likely to play an important part in energy supplies, especially converters for solar energy. The level of development and the future prospects of solar systems are reported on. The situation on the market for solar systems is also discussed.

6983 (NP—22377) **Solar energy activities of Arizona Public Service Company.** Brown, M.L. (Arizona Public Service Co., Phoenix (USA)). Feb 1977. 12p. TIC.

Activities in which Arizona Public Service Company is involved include: selective thin films, solar swimming-pool heaters, fixed cylindrical mirror solar collectors, solar energy for load management, and solar panels for powering VHF stations. Also, involvement with EPRI, ERDA, FEA, and the Western Energy Supply and Transmission Associates is discussed. (WHK)

6984 (TID—27755) **Project SAGE. Solar assisted gas energy. Interim report No. 1.** (Jet Propulsion Lab., Pasadena, Calif. (USA)). Apr 1976. 18p. Dep. NTIS, PC A02/MF A01.

Project SAGE is in the third phase—calling for the field installation of two SAGE systems—one to be built onto an existing apartment structure, the other to be incorporated into a new apartment structure during construction. The field design and construction of an installation on an existing apartment structure are discussed.

GEOTHERMAL

REFER ALSO TO CITATION(S) 6357, 6364, 6366, 6368, 6369, 6370, 6371, 6416, 6417, 6419, 6421, 6425, 6427, 6437, 6442, 6443, 6493

OTHER

REFER ALSO TO CITATION(S) 6509, 6510, 6513, 6926

ENERGY CONVERSION

MHD GENERATORS

MATERIALS, COMPONENTS, AND AUXILIARIES

6985 **Pitot tube in MFD flows.** Krause, S. (DFVLR-Inst fuer Plasmadyn, Stuttgart, Ger). *AIAA [8]Am. Inst. Aeronaut. Astronaut.[9] J.;* **15**: No. 6, 775-776(Jun 1977).

The Pitot tube is examined for possible application in magnetofluid dynamic (MFD) flows--i.e., flows which occur typically in MHD channels for power generation. Theoretical interpretations of the probe reading and a few illustrative experiments are reported. 6 refs.

DUCT ENGINEERING AND FLUID DYNAMICS

6986 (NP—22622) **Contribution to the calculation of a cylindrically symmetric inductive MHD generator with special consideration to finite length.** Djamali-Schahni, D. (Technische Univ. Berlin (Germany, F.R.)). 31 Jul 1975. 100p. (In German). Dep. NTIS (US Sales Only), PC A05/MF A01.

The end effects and their influence on the performance of a cylindrically symmetric MHD induction generator or polysolenoid are considered. Finite-width effects do not occur because of rotational symmetry. In order to determine the principal performance of the converter an infinitely long arrangement is investigated first. Then the fringing field outside of the stator on the surface of the inner iron core is numerically calculated. Finite length is handled by assuming the air-gap to increse from the ends of stator iron exponentially as this gives roughly the same fringing field shape on the surface of the inner core as is obtained from the exact numerical calculation. The magnetic flux density, air-gap and stator current sheet are represented by Fourier series and the resulting system of equations is solved for the magnetic field. From the field all other quantities are determined. Finally this converter is compared with an equivalent plane one.

6987 **Slag interaction phenomena on MHD generator electrodes.** Stickler, D.B.; DeSaro, R. (Avco Everett Research Lab., Inc., MA). *J. Energy;* **1**: No. 3, 169-179(1977).

Coal slag layer development and equilibration in an open-cycle MHD generator has been investigated. The purpose is to define requirements imposed on flow system and electrode design by generator operation on potassium-seeded plasma produced by direct coal combustion. Experiments at 0.7 kg/sec flow have been conducted using clean fuel with oxygen-enriched air, with coal ash fed to simulate coal combustor mineral carryover. Results indicate that a stable flowing slag layer can be developed, that it is self-renewing via deposition from the gas and shear flow, and that it is compatible with base-load generator operation. Constraints on combustor slag carryover quantity and composition, system flowfield, and electrode design are described.

6988 **Stability of slag in turbulent MHD boundary layers.** Saric, W.S. (Virginia Polytechnic Inst. and State Univ., Blacksburg); Touryan, K.J.; Scott, M.R. *J. Energy;* **1**: No. 2, 108-114(1977).

From 9. AIAA fluid and plasma dynamics conference; San Diego, CA, USA (14 Jul 1976).

The general problem of liquid layer stability is considered in the presence of body forces, and the pressure and shear perturbations generated by an external gas flow. In particular, linear stability analyses are applied to a liquid slag layer driven by a turbulent gaseous boundary layer in the presence of electromotive forces in an MHD channel. It is shown that entrainment of slag could occur in subsonic flows but that the slag layer is stable in supersonic flows. Typical results exhibit disturbance growth rates, phase velocities and disturbance frequencies as functions of liquid Reynolds number and interface shear stress. Within the restrictive assumptions of the analysis, the results show reasonable agreement with available experimental data.

THERMIONIC CONVERTERS

DESIGN AND DEVELOPMENT

6989 (COO—3056-25) **ERDA/NASA advanced thermionic technology program. Progress report No. 23.** (Thermo Electron Corp., Waltham, Mass. (USA)). May 1977. Contract EY-76-C-02-3056. 24p. Dep. NTIS, PC A02/MF A01.

Research progress is outlined in the areas of surface studies (basic experiments and direct beam chamber), plasma studies (converter theory and advanced mode conversion experiments), component development (low-temperature and high-temperature converter experiments), and component hardware (hot shell development). (WHK)

FUEL CELLS

DESIGN AND DEVELOPMENT

6990 **Hydrogen fuel cells.** Breelle, Y.; Cheron, J.; Degobert, P.; Grehier, A. (Inst fr du Pet). *Rev. Gen. Electr.;* **86**: No. 1, 24-30(Jan 1977). (In French).

After an explanation of hydrogen-air fuel cell principles and of its design and operating features, last decade's progress in this field is illustrated with realizations of the Institut Francais du Petrole: increased electrode performances, progress in fuel-cell construction techniques and battery auxiliary equipment. The interest in hydrogen-air fuel cell is enhanced by the future prospects of hydrogen as a widely available fuel, due to the nuclear plant development.

Fuel cell batteries will be used as autonomous power units (power capacity greater than 400 Wh/kg) and in automotive electric traction.

6991 Methanol-air fuel cells with buffer electrolyte. Bono, P.; Horowitz, H.H.; Heath, C.E. (Alsthom, Fr). *Rev. Gen. Electr.;* **86**: No. 1, 31-34(Jan 1977). (In French).

A study is carried out to determine whether it might be possible to develop a commercially practical direct methanol-air fuel cell using a buffer electrolyte, to avoid the problem of carbon dioxide formation in alkaline electrolyte. It is not found possible to reach the target power levels of 4.5 W/m^2 at temperatures up to 90°C for a number of reasons. The relatively low concentrations and diffusion constants of the carbonate and bicarbonate ions limit the current densities of the cell. The anode is substantially less active in buffer than in alkali. The catalyst is also sensitive to poisons. The potential of carbon cathodes does not rise as the pH falls from 14 to 10 in the expected manner, causing reduced cell voltages. Any attempt to put noble metal at the cathode is thwarted by the oxidation of methanol by the noble metal. Methanol is also lost by evaporation into the gas stream. An attempt was made to raise the temperature of the cell to 150°C by using concentrated cesium carbonate bicarbonate electrolytes. However, the gain in electrode activity was largely offset by the drop in methanol concentration under these conditions. Thus, all the potential advantages of a direct methanol-air cell could not be turned into practical reality.

6992 State of the research work concerning fuel cells. Bronoel, G.; Sarradin, J. (CNRS, Fr). *Rev. Gen. Electr.;* **86**: No. 1, 19-23(Jan 1977). (In French).

A brief review on fuel cell research is presented. It is noted that, in addition to economic requirements, the lines of research are directed towards different possible applications. Thus, in the U.S.A., such important organisations as EPRI and ERDA support financially a program intended for the supply of electric energy (power stations and collective equipment). In Western Europe, the efforts are mostly directed towards basic research associated with more limited technological development work. 10 refs.

PERFORMANCE AND TESTING

REFER ALSO TO CITATION(S) 6997

6993 (ANL—77-56) **Advanced fuel cell development progress report, April—June 1977.** Ackerman, J.P.; Kinoshita, K.; Sim, J.W.; Swaroop, R.; Nelson, P.A. (Argonne National Lab., Ill. (USA)). Aug 1977. Contract W-31-109-ENG-38. 22p. Dep. NTIS, PC A02/MF A01.

This report describes advanced fuel cell research and development activities at Argonne National Laboratory (ANL) during the period April—June 1977. These efforts have been directed toward understanding and improvement of molten-carbonate-electrolyte fuel cells operating at temperatures near 923 K. A primary focus of the work has been on developing electrolyte structures which have high strength and conductivity, as well as good electrolyte retention, and on developing methods of synthesis for electrolyte structures that are amenable to mass production. A low temperature synthesis which produces material having rodlike particles of β—$LiAlO_2$ has been refined and is now used for preparing electrolytes. Cell testing is essential for understanding and evaluating individual component behavior and the interactions of the components under realistic operating conditions. Most of the testing to date has been conducted in a 7-cm ($2^3/_4$-in.)-dia cylindrical cell with Type 316 stainless steel housings and current collectors, a nickel anode, and a nickel oxide cathode. Testing has begun to probe the roles of anode, cathode, and electrolyte in cell performance, and has provided verification of an acceptable technique for prevention of seal corrosion for at least 1400 hours. Components evaluation and development include post-test analysis and evaluation of cell components and materials, as well as development of out-of-cell diagnostic tests for the individual components. Particular attention is being paid to evaluation of the physical properties of the electrolyte and of the porous nickel and nickel oxide electrodes.

MATERIALS, COMPONENTS, AND AUXILIARIES

REFER ALSO TO CITATION(S) 6991, 6993

6994 (EPRI-EM—505) **Improved cathodes for phosphoric acid fuel cells. Final report.** (Case Western Reserve Univ., Cleveland, Ohio (USA)). Jun 1977. 91p. Dep. NTIS, PC A05/MF A01.

The purpose of this research has been (1) to explore alternative catalysts to platinum for O_2 reduction in phosphoric acid fuel cells; and (2) to establish the factors which control the catalytic activity of platinum for O_2 reduction in H_3PO_4. O_2 reduction has been examined on a number of electrode surfaces with both rotating disk and gas fed electrodes. Particular emphasis has been placed on transition metal monomeric and polymeric phthalocyanines. The iron and cobalt complexes have substantial activity for O_2 reduction but are still well short of that for Pt and have long-term stability problems in 85% H_3PO_4. Solution-phase transition metal macrocyclics such as the cobalt and iron tetrasulfonated phthalocyanines adsorb very strongly on graphite in acid and also alkaline solutions. These adsorbed layers have been found to catalyze O_2 reduction with the reaction proceeding through peroxide in acid and alkaline solutions. This in situ catalyst adsorption technique is a promising approach to electrocatalysis. As the research proceeded, it bacame increasingly evident that transition metal macrocyclics are not likely to be found that are superior to platinum in terms of activity and lifetime in phosphoric acid at temperatures above 150°C. Consequently the objectives of the project were broadened to include the identification and optimization of the factors which control O_2 reduction on platinum in phosphoric acid. Kinetic studies on Pt in purified 85% H_3PO_4 indicate O_2 reduction via two parallel mechanisms with the non-peroxide pathway predominant over the peroxide pathway. The Tafel slope is -0.12 V/decade at potentials below those for anodic film formation and is essentially independent of temperature over the range 25 to 150°C. The heat of activation for O_2 reduction to water is approximately 10 kcal/mole.

6995 (ERDA/NASA/1002—77/2) **Anion exchange membranes for electrochemical oxidation-reduction energy storage system.** O'Donnell, P.M.; Sheibley, D.W.; Gahn, R.F. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Aug 1977. Contract EX-76-A-31-1002. 23p. (NASA-TM—73751). Dep. NTIS, PC A02/MF A01.

Oxidation-reduction couples in concentrated solutions separated by appropriate ion selective membranes are an attractive approach to bulk electrical energy storage. A key problem is the development of the membrane. Four promising types of anionic membranes which were developed and evaluated for the Redox Energy Storage System are discussed. The copolymers of ethyleneglycoldimethacrylate with either 2-vinylpyridine or vinylbenzyl chloride gave stable resistance values compared to the copolymer of vinylbenzlchloride and divinylbenzene which served as the baseline membrane. A polyvinylchloride film aminated with tetraethylenepentamine had a low resistance but a high iron transfer rate. A slurry coated vinylpyridine had the lowest iron transfer rate. All these membranes functioned well in laboratory cells at ambient temperatures with the acidic chloride oxidant/reductant system, Fe III, Fe II/Ti III, Ti IV.

6996 Nuclear resonance investigtion of hydrogen mobility in chromous acid (α-$HCrO_2$). Follstaedt, D.M.; Biefeld, R.M.; Ginley, D.S. (Sandia Labs., Albuquerque, NM). *Mater. Res. Bull.;* **12**: No. 4, 389-392(Apr 1977).

There is considerable interest in developing a hydrogen ion conducting solid electrolyte because solids with fast proton conduction could be of considerable utility as separators in fuel cells. Chromous acid ($HCrO_2$) was chosen as a possible hydrogen ion solid electrolyte because of the similarity of its structure to that of the well known solid electrolyte, Na β-alumina. The structure of α-$HCrO_2$ consists of continuous sheets of $(CrO_6)^{-9}$ octahedra. The oxygen ions of adjacent sheets are exactly superimposed and are connected by hydrogen ion bridges. The hydrogen ions form a continuous two-dimensional layer. In Na β-alumina, sheets of aluminum and oxygen ions are separated by layers of sodium and oxygen ions. Since the sodium ions are known to diffuse rapidly between the sheets of aluminum and oxygen ions it was thought that the hydrogen ions might also diffuse between the sheets of $(CrO_6)^{-9}$ octahedra in $HCrO_2$. To search for evidence of H^+ diffusion, NMR measurements of the proton relaxation times were done and were found to be temperature independent between 24 and 400°C. The absence of motional narrowing requires H^+ diffusion times to satisfy tau/sub jump/ greater than or equal to T_2 = 30 μsec at 400°C. Thus α-$HCrO_2$ does not appear promising as a hydrogen ion solid electrolyte. (WHK)

ELECTROCHEMISTRY, MASS TRANSFER, AND THERMODYNAMICS

6997 Principles of exergetic analysis of electrochemical energy generators. Nesterov, B.P.; Korovin, N.V.; Brodyanskii, V.M.; Trerdokhlebov, E.S. (Moscow Power Eng Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 3, 61-66(Mar 1977). (In Russian).

An exergetic analysis of electrochemical energy generators (ECEG) is carried out and the functional dependence of the exergetic efficiency of a two-loop ECEG system on exergetic efficiencies of ECEG subsystems is demonstrated. A hydrazine-oxygen ECEG is analyzed by the exergetic method. Based on these calculations, a diagram of exergy flows in an ECEG is constructed and it is shown that, under selected conditions of operation, the highest exergy losses exist in a battery of fuel elements. 9 refs.

ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 6847, 6874, 6919, 6934, 6935, 6939, 6977

6998 (E/ECE—883(Rev.1)) **Increased energy economy and efficiency in the ECE region. Study on measures taken, or which might be taken, to achieve increased economy and efficiency in the extraction, conversion, transport and use of energy in the ECE region.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 1976. 107p. Nations Sales Section, New York, NY $6.00.

A study, based on information from 22 European countries and the USA, on measures taken or planned in order to achieve increased economy and efficiency in the extraction, conversion, transport and use of energy in the Economic Commission for Europe (ECE) region is reported. The economic framework for energy-saving measures is analyzed by examining the relationship between energy use and economic growth, identifying the major energy-saving industrial branches and products, and reviewing past trends in energy prices relative to those of other products. The amounts of energy lost in the conversion, transport, and use of energy in Europe and the USA are graphically presented. Specific possibilities for increasing efficiency and economy are examined, and potential and practically attainable savings in the various stages of the energy process--extraction, conversion, transport and use--are estimated. A broad estimate is included of the over-all savings which might be attainable during the period up to 1990 if the appropriate measures are taken in time. Information (as of 1 Dec. 1975) on governmental measures intended to achieve energy savings which have been taken or are planned in ECE countries are presented. Some general conclusions based on the preceding information and analyses and possible lines for further cooperation in the ECE framework aimed at helping governments cope with the problem of increasing energy efficiency and economy are indicated. (LCL)

6999 **Status of legislation related to energy conservation.** Ratchford, J.T. pp A3-A6 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

The objectives and status of U.S. federal legislation related to energy conservation are discussed briefly. These congressional bills deal with subjects such as daylight savings time, highway speeds, creation of the FEA and ERDA, solar heating, and nonnuclear energy research. (LCL)

BUILDINGS

REFER ALSO TO CITATION(S) 6272, 6904, 6906, 6914, 6915, 6916, 6927, 6975

7000 (CONF-770804—12) **Heat pump cycle with an air—water working fluid.** Hise, E.C.; Wilson, J.V. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 22p. Dep. NTIS, PC A02/MF A01.

From 12. intersociety energy conversion engineering conference; Washington, District of Columbia, United States of America (USA) (28 Aug 1977).

A new thermodynamic cycle for heat pumps is discussed. The cycle resembles the Joule cycle in that it consists of an isentropic compression, a constant pressure heat rejection, an isentropic expansion with work recovery, and a constant pressure heat addition. It differs from the Joule cycle in that the working fluid is not a single gas but is instead a mixture of a gas and liquid which can appear as all four phases during the course of the cycle and undergoes at least one phase change in each process. The polytropic indices of compression and expansion can range from 1 to 1.4. A special case is described in which the heat source is the heat of fusion of water. A mathematical analysis is given and the results presented graphically. The cycle is compared to the Joule, Rankine, and Carnot and it is shown that, operating between source and sink temperatures suitable for space heating, the theoretical coefficient of performance (COP) can approach that of the Rankine cycle. Using air and water as the working fluid, the cycle may be a viable alternative to the existing Rankine systems.

7001 (CONS/2109—1) **Infrared thermography requirements study for energy conservation.** Headley, R.B.; Larsen, R.J.; Goldberg, G.G.; Boyd, R.J. (Aerodyne Research, Inc., Bedford, Mass. (USA); NAHB Research Foundation, Inc., Rockville, Md. (USA)). Apr 1977. Contract EX-76-C-01-2109. 152p. Dep. NTIS, PC A08/MF A01.

A description is given of a study to identify users (and their needs) of infrared (IR) instrumentation that may be applicable in the measurement of heat gains and/or losses from buildings, and to identify research, development and demonstration opportunities. The study is intended to provide the following information: (1) identify present and potential users and uses of infrared thermographic technology as related to energy conservation in buildings; (2) identify presently available IR thermographic instrumentation, techniques, and services, and determine how well it can serve the users and uses identified above; and (3) identify the technical opportunities for research, development, and demonstration on new IR thermographic technology that will better serve the users and uses identified above. The building sector requirements were analyzed, the user measurement requirements were identified, and cost guidelines for instrumentation are provided. An analysis is given of the constraints, requirements, and limitations of measurable parameters. This analysis provides the basis against which an IR instrument survey was conducted. The building sector requirements study indicates the general satisfaction of the user community with the use of IR thermography for qualitative evaluation of heat loss from buildings.

7002 (FEA/D—77/208) **Impact of load management strategies upon electric utility costs and fuel consumption.** (Systems Control, Inc., Palo Alto, Calif. (USA)). Jun 1977. 150p. Dep. NTIS, PC A07/MF A01.

This report provides an analysis of the potential benefits to electric utilities from the implementation of load management. Reductions in operating costs were calculated, utilizing a probabilistic simulation of the operation of two representative U. S. utilities. For one utility, reductions in operating costs were found to be highly dependent upon reductions in peak loads; for the other utility, reductions in total energy generated were found to have a greater effect. Three specific strategies, time-of-day rates, remotely controlled water heaters, and improved residential insulation were tested. A brief analysis was made of additional benefits from reductions in capital expenditures.

7003 (NP—22257) **Computer file of New Zealand climate.** Leslie, S.F.; Trethowen, H.A. (Building Research Association of New Zealand (Inc.)). Apr 1977. 9p. Dep. NTIS (US Sales Only), PC A02/MF A01.

An hour-by-hour computer file of climatic data, named SUSTEP/CLIMDATA is described. This file has been constructed from the New Zealand Meteorological Service computer files of hour-by-hour weather records for a number of centres. Unfortunately, no solar radiation or night sky radiation data are contained on the original files. As part of an energy conservation project funded principally by the New Zealand Energy Research and Development Committee new versions of these climatic files, including hourly direct and diffuse irradiance on a horizontal surface, have been prepared.

7004 **Optimising heat exchangers for air-to-air space-heating heat pumps in the United Kingdom.** Blundell, C.J. (Electr Counc Res Cent, Capenhurst, Chester, Engl). *Int. J. Energy Res.;* **SMC-7**: No. 5, 340-349(May 1977).

After a discussion of heat-transfer theory, a method is described that can be used in the design and sizing of air-to-refrigerant heat exchangers and in calculating temperature distributions. As an illustration, economically optimum sizes for exchanger coils are given for heat pumps of output 13.9 kW, 5.6 kW and 5 kW at 5°C outside the ambient temperature. At several stages, manufacturer's experimental data have been used, and the final results are compared with the design of heat exchangers used in commercially available models. Some temperature measurements made on a heat-pump installation in an experimental house are also reported. At least doubling the size of presently used indoor coils is shown to be economically justifiable, increasing the seasonal coefficient of performance from about 2.4 to 2.8 to 3.0. Reassessment of outdoor-fan size is also shown to be necessary.

7005 **Evaluation of the energy demand for a variety of possible air movement paths through space.** Detzer, R. (Kessler und Luch, Giessen, Ger). *Klima Kaelte Ing.;* **5**: No. 4, 135-138(Apr 1977). (In German).

For the achievement of high efficiencies in air conditioning installations and for keeping at the same time within the recommended limits of air speed, it is necessary to reduce as far as possible the heat loads within the area occupied by man. It is shown that a favorable selection of the supply and return air flow will increase the "efficacy" of the installation.

7006 **Automation of combined district heating boilers of the KTK-100 type.** Kuvshinov, A.A.; Spivakov, V.L.; Krylov, A.K. (All-Union Sci Res and Plann Inst, USSR). *Energomashinostroenie;* No. 5, 38-39(1977). (In Russian).

Various variants of automatic control of steam pressure at the outlet from the boiler and of the temperature of direct supply network water are considered.

7007 Highly insulated window glazing. Mahdjuri, F. (Phillips Forschungslaboratorium G.m.b.H., Aachen). *Int. J. Energy Res.;* **1**: No. 2, 135-142(1977).

A short survey is made of heat-transfer processes through a double-glazed window system. Network calculations show the advantage of a double-glazed window including at least one heat-reflecting filter and an infrared transparent foil. The best configuration is found to have the coated sheet at or near the center. In the optimum system with one foil, the net energy loss is slightly below 1 W/m^2K. Several insulating glazing systems with air and with krypton filling are compared, and all net energy loss values are calculated. The application of an infrared-transparent foil to a solar collector is discussed, and the measured top losses are given. 10 references.

7008 Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975). vp. (CONF-741010—P2).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

Eight papers on heating and air conditioning equipment were presented. A separate abstract was prepared for each paper. (LCL)

7009 Status of energy standards for heating, ventilating and air-conditioning systems in buildings. Achenbach, P.R. (National Bureau of Standards, Washington, DC). pp A134-A139 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

The role of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, the National Bureau of Standards, and the Federal Energy Agency in evolving standards for energy conservation in buildings and standards for building construction and building equipment, especially heating and cooling equipment, design and performance are discussed. (LCL)

7010 Thermal efficiency in non-modulating combustion systems. Bonne, U.; Johnson, A.E. (Honeywell, Inc., Bloomington, MN). pp 1-17 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

A model of a combustion heating system was derived which describes its energy utilization efficiency. The model is based on the loss method, employs primarily intensive parameters and can be used with reference to the HHV or LHV of a variety of fuels. The data obtained experimentally served to provide realistic ranges for the parameters used to calculate changes in the overall thermal efficiency. The largest single loss of about 15 to 16% of a reference heating system is due to drafts through the combustor and heat exchanger during the "off" cycle. This loss, as well as "off" cycle "system" losses, indicates that total system thermal efficiency can be significantly lower than the full load standard (steady state) equipment efficiency, especially in oversized, non-power, non-modulating burners.

7011 Design of air handling systems for energy conservation. Turner, L.B. (United McGill Corp., Westerville, OH). pp 48-54 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The air handling system, be it large or small, is an integral part of the HVAC system of a building and should be given adequate consideration in the design stage. It is possible to make significant savings in the energy requirements of the system by careful design of the duct work and by proper selection of the various components. Particularly in the choice of divided flow fittings, attention should be given to the conparative efficiencies of the different fittings which might be used at a particular location. Any energy savings which can be accomplished in the design of the ductwork will be reflected in the operating cost of the entire system.

7012 Air side energy conservation techniques. Hallstrom, A.D. (Trane Co., La Crosse, WI). pp 62-66 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

During the initial or preliminary design of the building is when the engineer has the greatest opportunity to design an optimized air side system. The energy that the air side system consumes is normally 10 to 50% of the building's total energy budget. The optimization of various system/design parameters in the initial design stages can lead to a building which comes close to meeting some of the recently published energy guidelines. There are many system pearameters to be optimized in the air side system. However, the majority of the energy can be attributed to some basic parameters. They include the air side system and its controls, economizer, amount of outside air, operating schedule, fan static pressure and fan type to include motor efficiency. The effects on energy consumption and operating cost of the type of air side system, the total system static pressure, and the fan selection are analyzed using a dynamic building simulation program called "Trane Air Conditioning Economics" (TRACE) as applied to a typical one-story office building in Chicago. It was found that economic optimization and determination of trade-offs of air side system parameters can be solved correctly and easily using the TRACE program. (LCL)

7013 Compressor contributions to room air conditioner efficiency. Jobes, H.W. (Tecumseh Products Co., MI). pp 73-76 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The development of more efficient room air conditioners and, particularly, the building and testing of air conditioning compressors in order to optimize the design and produce high capacity, low wattage, hermetic compressors are discussed. It is concluded that, based on present technology, the energy efficiency rating (Btu/W-hr) projected for room air conditioners are near the practical limitations of compressor design consistent with rational economics, and that further improvements depend on the introduction of improved refrigerants, customer demand for longer service life units, and enactment of energy conservation legislation. (LCL)

7014 Hermetic motor efficiency. Johnson, J.H. (General Electric Co., Holland, MI). pp 77-83 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

Improvements in the energy efficiency ratio (EER) of air conditioners may in part come from improved motor efficiency. Increased motor efficiency is obtained only through increased motor material content or lower loss material except where other specification requirements can be relaxed. The amount of material allotted to the magnetic flux-carrying member (steel) and the current-carrying member (copper and aluminum conductor) is related not only to the motor efficiency, but also to the thermal characteristics of the motor-compressor system. A small stator slot will result in less conductor material, higher conductor temperatures and lower losses in the steel. A large stator slot will result in more conductor material, lower conductor temperatures and higher steel losses. The optimum motor design must include consideration for the relative cost of steel and conductor, the allowable winding temperature at the light and heavy loads, and the total losses over the entire range of motor operation. Still further, from an energy optimization standpoint, the optimum design should include a time integration of the energy consumption over an entire season's operation.

7015 Heat transfer surface efficiency. Malhotra, R.K.; Simison, C.B. (Bohn Aluminum and Brass Corp., Danville, IL). pp 84-90 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The air conditioning industry has spent considerable effort developing surfaces for improved BTU/dollar and BTU/space performance considerations. It is now anxious to evaluate existing fin patterns and develop new patterns to improve efficiency in light of current BTU/watt requirements. The design and performance of dry finned-tube heat exchangers for room air conditioners are discussed. It is concluded that it is not realistic at this time to expect that the overall coil performance would increase more than 10 to 15% over todays' best surfaces. However, it should again be noted that larger coils, especially the condenser with optimized circuiting, will always offer a definite potential for higher BTU/watt. This design feature would normally come at a cost premium, but the use of different materials, such as aluminum tubing in place of copper, has the potential to overcome all or a portion of this cost increase. (LCL)

7016 High efficiency heat pipe system to meet total thermal requirements for small buildings. Pessolano, R.L.; Beals, R.A. (Isothermics, Inc., Augusta, NJ). pp 104-106 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The design and operation are described of the BTU-2X (Better Thermal Utilization--Two-way System) which combines in an integrated unit a hot air and hot water heating system for a small building. Heat from any energy source is transferred simultaneously or alternately to either air or water by means of a bank of heat pipes. The warm air is used for space heating. The hot water section has a storage tank for domestic hot water or for storing heat to be transferred to the air section. The system can store solar energy and may recover waste heat from other thermal appliance for use in augmenting the system's heat input. Overall the BTU-2X with its heat pipe heat exchange has simplicity of operation, is compact, minimizes heat losses, performs multiple functions, and conserves energy with improved space heating comfort. (LCL)

7017 Energy reclaiming modular self-contained multizone unit. Gilles, T.C. (Lennox Industries Inc., Marshalltown, IA). pp 117-125 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The design, operation, and prototype performance of a modular multizone heating, ventilating and air conditioning unit that can simultaneously supply heating and cooling to different zone areas of a building are described. This prototype offers energy recovery characteristics that allow this system to consume less total energy per year than a multiplicity of single zone units serving several zones. (LCL)

7018 Life cycle costs for HVAC using computerized energy studies. Eppelheimer, D. (Trane Co., La Crosse, WI). pp 140-142 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The necessity for using a computer program to calculate the energy consumption in a building is explained. Three examples are given on computerized life-cycle costs. The speed of the computer allows life-cycle costs to be calculated accurately and quickly. This discussion is focused on Life Cycle Costs for HVAC systems, using Computerized Energy Studies. Today, the use of value management, through life cycle costing, is one of the most significant tools used to conserve energy.

7019 Life-cycle evaluation of small/medium HVAC systems to promote energy conservation. Dressler, F.R.S. (University City Science Center, Philadelphia). pp 143-146 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

A practical means of life-cycle evaluation for small/medium HVAC systems to promote energy conservation is presented. The overall approach extends present practice to explicitly consider energy price escalation and life-cycle values. A single evaluation criterion is recommended--the present value of a system's life-cycle cost, PVSC. Calculation procedures for PVSC are fully developed and explained. Procedures for small and medium HVAC systems are detailed and make full use of present practice and conventional concepts of system cost.

7020 High efficiency compressors: design and application. Massa, D.J.; Ralph, T.G. (Copeland Corp., Sidney, OH). pp 155-160 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The selection and application of compressors is discussed, and recent compressor improvements which result in significantly increased system efficiency are described.

7021 Jet impingement condenser fin coil. Nydick, S.E.; Searight, E.F. (Thermo Electron Corp., Waltham, MA). pp 161-171 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The development of a design approach which has the potential of reducing the manufacturing cost of finned-tube air conditioning condenser coils is described. The method involves the application of jet impingement heat transfer on the air side of the condenser coil which increases the air side heat transfer coefficient, thus increasing the overall heat transfer coefficient. Fin surfaces with increased air side heat transfer coefficients are able to increase the overall heat transfer coefficients because, even for a high fin density and an efficient fin, the air side accounts for a significant part of the total resistance to heat transfer.

7022 Limitations of the infinite heat exchanger. Pietsch, J.A. (General Electric Co., Tyler, TX). pp 172-178 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The efficiency of air conditioning systems can be enhanced by increasing the capacity of the evaporator and by lowering the condenser temperature. This can be accomplished by increasing the size of the coil in the evaporator and/or condenser, or by increasing the air flow over the coil, or both. The effects of these changes are described. It is concluded that as more effective evaporators and condensers evolve, air conditioners will operate more efficiently without sacrificing comfort or reliability. (LCL)

7023 Efficiency prediction for axial fans. Wright, T. (Westinghouse Fluid Systems Research Lab., West Lafayette, IN). pp 179-184 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

Recent and continuing developments in the cost and scarcity of energy have led to a renewed emphasis on developing high efficiency HVAC equipment. The selection and design of axial fans represents one of many means of minimizing the input power requirement for such equipment, and the equipment designer is faced with a large array of available fans and a large number of important parameters which will significantly affect the efficiency of a given axial fan installation. A systematic scheme is presented for predicting the efficiency of a fan and fan installation in a sufficiently compact calculation scheme to enable a designer to examine the merits of a

proposed layout and to evaluate the performance penalties associated with size, speed, blade geometry, and clearance constraints.

7024 Development of high efficiency blading for air conditioner condenser fans. Weigand, G.G.; Wright, T. (Westinghouse Fluid Systems Research Lab., West Lafayette, IN). pp 185-193 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

Results are presented of an analytic study and experimental investigations which show where the use of a new fan blade profile can result in significant electric power savings in the operation of air conditioners. (LCL)

RESIDENTIAL BUILDINGS

REFER ALSO TO CITATION(S) 6907, 6911, 6917, 6929, 6984

7025 (BNL—50684) **Field method for determination of the performance parameters of an operating structure and its heating system.** Berlad, A.L. (Brookhaven National Lab., Upton, N.Y. (USA)). Jun 1977. Contract EY-76-C-02-0016. 36p. Dep. NTIS, PC A03/MF A01.

A method is presented for measuring the heat load for any particular house and the efficiency of its fossil-fuel fired heating system and for using this data to accurately calculate the seasonal performance of the specific house with its heating system. This method provides data on the efficiency of the heating system, house heat load characteristics, and appropriateness of heating system size, and permits the house owner to determine the fuel savings obtainable from proposed changes to the house and/or heating system, and the economics of the fuel cost saving versus the capital cost of the improvements. (LCL)

7026 (CONF-770804—11) **Energy and economic effects of residential energy conservation programs.** Hirst, E.; Carney, J. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 7p. Dep. NTIS, PC A02/MF A01.

From 12. intersociety energy conversion engineering conference; Washington, District of Columbia, United States of America (USA) (28 Aug 1977).

A detailed simulation model of residential energy consumption is used to evaluate the energy and direct economic effects of several conservation programs: appliance efficiency targets, thermal standards for new construction, and retrofit of existing housing units. Results suggest that each of these programs saves energy and saves money. For example, these programs could cut energy use in the year 2000 by 15 to 25 percent and save households $25 to $45 billion between now and 2000.

7027 (NMEI—76-155) **Data base for fixed- and low-income owner-occupied housing units.** Adcock, L.; Bowers, R.; Driftmier, E.; Dunlap, R. (New Mexico Univ., Albuquerque (USA). Bureau of Business and Economic Research). 7 Jan 1977. 56p. Mexico Energy Inst., Albuquerque, NM.

The cost of weatherization--weather stripping and caulking and provision of 10-mill plastic covers for windows--varies from one structure to another. This study provides the cost estimates for an average sized home of 1,100 square feet in New Mexico by means of two methods. Method II, using an index of change for low- and fixed-income owner-occupied units from 1970 to 1975, provides the higher cost estimates. Wall- and roofing-insulation costs are also estimated within the study. The cost of insulating walls in existing homes is based on the use of polyurethane foam which is injected into existing units of frame-type construction. The study assumes that foam injection is the only viable economic alternative for insulation of existing frame structure units. Other methods, such as the attachment of styrofoam or other insulating materials to existing walls, could have been assumed. However, it is believed that foam currently offers the best and most economical process for insulating existing frame wall homes. The study shows that in an average 1,100-ft^2 existing frame type home the total cost of insulating would be near $8,315,000. The study gives information on pitched-roof insulation costs for those homes occupied by fixed- or low-income households. The total cost of the weather stripping, caulking and window weatherization program for materials only is close to $3,360,000. The total cost for foam wall insulation in existing structures and insulation of those homes with pitched roofs for families of fixed and low incomes is nearly $19,723,000. Thus, for a total weatherization program for owner-occupied dwellings where the households have fixed or low incomes, the cost would be almost $23,083,000.

7028 Efficiency factors for domestic oil heating units. Turner, D.W.; Holmes, R.E.; Kraus, B.J.; Coburn, J.F. (Exxon Research and Engineering Co., Linden, NJ). pp A18-A29 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

During the 1973—1974 heating season, a program to determine the efficiency of domestic oil heating units was undertaken. The test had two objectives; to evaluate the efficiency of the burners in the field and to determine means by which the efficiency could be increased to conserve fuel. The field test was conducted in northern New Jersey. The domestic oil heating units in the field represented a good distribution of heat type (steam, hot water, and warm air). The results of the 11 heating units demonstrated the feasibility of fuel savings via optimized firing rates. The one unit test with a stack damper has shown that additional savings can be achieved provided all downtime losses can be eliminated. The losses associated with the absorption efficiency and the downtime account for about 40% of the heat in the fuel and result in an overall efficiency factor of 60% for existing units. Optimized firing rates in these burners appear to have the capability of increasing this efficiency up to 67%. These values reflect what is felt to be a reasonable estimate of the overall efficiency of domestic oil heating units in the field.

7029 Electric resistance heating proves energy-efficient. Dunning, R.L. (Westinghouse Electric Corp., East Pittsburgh, PA). pp A40-A50 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

The efficiency of residential oil furnaces and gas furnaces and electric heating systems are discussed using data from tests on several hundred houses at various U.S. locations. Losses in fossil-fuel heating systems are described, and the overall energy consumption in houses for heating, lighting, and appliances are compared. It is concluded that electric resistance heating is not energy wasting as compared with fossil-fuel systems and has the advantage of using coal and uranium as the primary energy sources for electric power generation, thereby saving scarce fuels such as oil and natural gas. (LCL)

7030 Sealed oil furnace combustion system reduces fuel consumption. Peoples, G. (Lennox Industries Inc., Marshalltown, IA). pp A66-A73 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

A three phase program to define specific residential oil furnace combustion system losses and the development of hardware to control them is outlined. These phases are as follows: design and instrument a test room to measure the quantity of air required for combustion and barometric control; then convert this quantity to terms of energy losses; design the hardware to reduce these losses in both existing and new installations; and set up a field evaluation program for the 1974—1975 heating season.

7031 Demand defrost of heat pumps for residential and commercial air cooled equipment. West, J.E. (Lennox Industries Inc., Marshalltown, IA). pp A112-A116 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

There is much discussion in the heating, ventilation and air conditioning industry today regarding the heat pump and its greater efficiency of performance over heating by resistive heat. Since the heat pump obtains its greater heating capacity from outdoor air via the outdoor coil, the peak efficiency and thus minimum energy consumption is achieved by proper control of frost and ice formation on the outdoor coil. The history of the heat pump has seen many different methods of initiating a defrost cycle. Three methods are commonly being used today: differential temperature initiation, time

initiation, and air differential initiation or, more commonly called, Demand Defrost. Temperature and time initiation are briefly explained, and the Demand Defrost method is discussed in detail. The design and operation of Robertshaw De-ice Sensor are described. It is concluded that with the expanding heat pump market in colder climate areas it is important to achieve maximum heat pump efficiency, and that the demand defrost system which initiates defrosting only in the actual presence of frost or ice, regardless of temperature or time, can result in a significant improvement in heat pump efficiency. (LCL)

7032 Availability consumption by heat pumps. Harden, D.G.; Calvert, F.O.; Ewbank, W.J. pp A117-A120 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

Available energy consumptions analysis shows the heat pump to be a contender for heating and cooling because of its effective use of energy. Further analysis of the heat pump as the system of interest will show that significant improvements in the heat exchangers and expansion valve concept can be made.

7033 Practical zone temperature control system for larger residential and light commercial applications. McQuiston, F.C. (Oklahoma State Univ., Stillwater). pp 32-36 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

A procedure is described for designing a satisfactory zone temperature control system for residential and light commercial applications using economical, commercially available components. The method makes use of the system and fan characteristics in a graphical procedure with a minimum of calculations. Sufficient experience has been obtained to prove out the concept. Performance of the system is outstanding with significant savings in fuel and operating costs.

7034 Possible energy conservation through use of variable capacity compressors. Cohen, R.; Hamilton, J.F.; Pearson, J.T. (Purdue Univ., Lafayette, IN). pp 37-41 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The usual residential or small commercial air conditioning systems use air cooled condensing sections. The instantaneous condensing temperature is a function of ambient air temperature, condenser air quantity, and the mass flow and superheat of the refrigerant entering the condenser. System energy requirements are currently expressed in terms of Btu/watt-hour at "design" ambient for normal applications. Present efforts within the industry seem aimed at increasing this value. Little or no regard is given to the effect on either the seasonal energy demand or on the energy required to produce the increased quantities of aluminum and copper demanded by increases in the size of heat transfer surfaces which this approach seems to employ. Thus the maximum energy effectiveness is not often met. It is shown that a different approach to energy effectiveness can give as much as 35% improvement without the need for a greater material usage in the heat transfer surfaces. Instead of using the conventional EER term of Btu/watt-hr in expressing performance, the inverse term, watt-hr/Btu, is used. This permits adding the energy requirements of the various system components to determine overall system energy efficiency, and is consistent with the practice of rating large systems in terms of KW/Ton. A general analysis is provided of the effects of the interactions of ambient air temperature, the system load, and the system response for the typical "package products" unit. No analysis is made of a specific unit, hence the results suggested may be analyzed by any product manufacturer to determine how his particular line of products can be made more energy effective on a life cycle basis by use of variable capacity compressors. Development of such a compressor and its early use in the equipment discussed could make a greater reduction in seasonal energy requirements of residential and small commercial air conditioning equipment than any other product design change.

7035 Duct design for balanced air distribution in low velocity systems. McQuiston, F.C. (Oklahoma State Univ., Stillwater). pp 55-61 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

A rational approach to the design of low velocity duct systems is developed. The procedure focuses attention on the total pressure available for the system before actual duct sizing begins. Sizing of the ducts is based on sound principles and gives a perfectly balanced system within the limitation of describing the system. The method has been in use for about three years in residential and light commercial design. The results have been excellent. On a number of occasions existing duct systems have been analyzed as an aid in balancing and rework with a considerable saving of time.

7036 Room air conditioner efficiency: potentials and limitations. Schulze, J.L. (General Electric Co., Louisville). pp 91-102 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

A room air conditioner is viewed as a system made up of four major functional subsystems which include: the heat transfer subsystem and its associated heat exchanger and air flow components; the vapor compression or reversed Rankine cycle which is the basis of operation; the compressor with its mechanical and electrical elements; and miscellaneous subsystems including piping, controls, insulations, and drains. The overall theoretical efficiency of the air conditioning system is analyzed by considering the theoretical efficiency of each of the subsystems, and the cost of improved equipment is considered. (LCL)

7037 Stirling engine as a total energy system prime mover. Daniels, A. (Philips Labs., Briarcliff Manor, NY). pp 126-134 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

A total energy system for residential use uses a prime mover to convert heat to the shaft work required to drive electric generators, air conditioners, and/or heat pumps and recovers prime mover waste heat for space heating use. The Stirling engine is especially suited as a prime mover for total energy systems. After a description of the operating principles of the Stirling engine, the characteristics of an existing engine suitable for demonstrating its applicability to total energy plants are presented and discussed. The discussion of the existing engine is followed by a presentation of a Stirling engine design optimized for the requirements of a total energy plant suitable for a typical one family residence. (LCL)

7038 Refrigeration and control matching for residential air conditioning systems. Marks, R. (Ranco, Inc., Columbus, OH). pp 194-199 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The coordinated design of a control system and a refrigeration system to conserve operating energy and improve comfort performance of a residential central cooling unit is described. This will be an overall review of the proposed control system and several options available for the refrigeration system. The problem with conventional cooling systems that is investigated is how to operate during the many hours of light cooling load condition to conserve energy and also to maintain desired comfort conditions. The conventional refrigeration system is modified for reduced load operation while maintaining as much as possible the ability to remove moisture for comfort. The use of outdoor air is suggested when outdoor air has the acceptable quality for cooling and the climate conditions are such that outdoor air can significantly reduce mechanical cooling energy usage. A control system is proposed to integrate all the modes of operation required by being responsive to the load.

7039 Evaluation and comparison of the energy efficiency ratios of various air-conditioning units in West Lafayette, Indiana. Voorheis, H.; Leonard, R.G.; Goldschmidt, V.W. (Purdue University, West Lafayette, IN). pp 214-220 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

In the past year a great deal of emphasis has been placed on the efficiency of energy conversion and use. Air conditioning units consume a large portion of the energy produced in this country in the summer months, and the efficiency of these air conditioning units has therefore become an important design factor. As an efficiency indicator, the Air Conditioning industry has adopted the Energy Efficiency Ratio (EER). The EER is defined to be the cooling capacity of the A/C unit divided by the total electrical power input. The manufacturers of A/C units are providing test data that allows one to calculate the EER under various operating conditions. However the EER of an A/C unit under test conditions may or may not equal the EER of that same A/C unit when it is operating in the field. The EER calculated using the manufacturer's test data is compared with the EER estimated from data obtained from units under actual operation. Additional measurements were taken on a Mobile Home unit with three different ducting configurations.

7040 Department of Commerce voluntary labeling program for household appliances and equipment to effect energy conservation. Meyerson, M.R. (National Bureau of Standards, Washington, DC). pp 222-225 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The Appliance Labeling Program of the U.S. Dept. of Commerce is aimed at encouraging manufacturers to provide consumers, at the point of sale, with information on the energy consumption and energy efficiency of household appliances including air conditioners, space heaters, refrigerators, freezers, water heaters, dishwashers, clothes washers, clothes dryers, stoves, and ovens. The implementation of the program and its contribution in influencing consumers to buy energy efficient equipment are discussed. (LCL)

OFFICE BUILDINGS

REFER ALSO TO CITATION(S) 6923

7041 (TID—27561) Site and building energy appraisal and survey methodology study. ANL-Site energy report. (Pope, Evans and Robbins, Inc., New York (USA)). 1976. Contract EX-76-C-10-3853. 388p. Dep. NTIS, PC A17/MF A01.

An energy survey of the Argonne National Laboratory is presented. Energy appraisal forms completed in accordance with the energy accounting methodology are given. The following factors were considered in the energy survey: (1) energy entering the site, (2) energy converted on the site, (3) energy generated on the site, and (4) energy distributed and consumed on site. (RCK)

7042 (TID—27562) Site and building energy appraisal and survey methodology study. ANL-Building 212 energy report. (Pope, Evans and Robbins, Inc., New York (USA)). Feb 1977. Contract EX-76-C-10-3853. 427p. Dep. NTIS, PC A19/MF A01.

An energy survey of Building 212 at the Argonne National Laboratory was performed to appraise the energy accounting methodology presented in the Building Energy Handbook (ERDA-76/163, Vols. 1 and 2) and to identify energy conservation opportunities (ECO) in this office/laboratory-type building with emphasis on those conservation measures which could be applied to similar buildings. The methods and data used are discussed in detail. Seventeen ECO's are identified and the cost of implementing these procedures and the savings expected are enumerated. It was concluded that 13 of the 17 ECO's identified could be implemented immediately with a minimum of investment and building use disruption, and that the most significant ECO concept is the variable air volume modification to all air systems. ECO appraisals done manually and on computers resulted in comparable conclusions. More frequent and more accurate metering of steam and electric power consumption is recommended. (LCL)

7043 Laboratory test of the modular concept as applied to gas-fired boilers. Kelly, G.E.; Didion, D.A. (National Bureau of Standards, Washington, DC). pp 18-30 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

The use of several small boilers (modules), which are sequentially fired to match the heating load, is referred to as the modular concept of boiler operation. This arrangement is purported to have the advantages over a single large boiler of easier installation and repair, standby capacity if one of the modules should become inoperative and increased system efficiency. This potential for increased efficiency and thus energy conservation of the modular boiler installation is discussed by describing performance tests on heating systems for an office building and a school and by calculating thermal efficiency of the modular boiler system as compared with a single large boiler. The results show that the gas-fired modular boiler installation could result in considerable (from 4 to about 10%) energy savings, with the higher savings achieved on oversized systems. However each potential application of the modular concept must be examined on an individual basis. (LCL)

SCHOOL, MUNICIPAL AND OTHER PUBLIC BUILDINGS

REFER ALSO TO CITATION(S) 6913, 7043

7044 Economically rational energy conservation program for institutional buildings. McClintock, M. Boston; Boston University Center for Energy Studies (1977). 17p. (NP—22496).

A methodology is developed which allows generation of an optimum energy conservation program primarily, but not solely, suited to institutional buildings. The method has the flexibility to allow assessment of (1) technical improvements to the building structures, (2) changes in maintenance and operation policies, (3) alternative energy technologies, and (4) educational aspects of energy conservation for administrative staff, maintenance and operation personnel, faculty, and students. The result of its application is an ordered conservation program in which savings realized from the first measures are used to underwrite the cost of later measures, and it is therefore possible to pay for a large part of the program out of cash flow rather than necessitating capital fund raising programs. Once instituted, of course, many energy conservation measures continue to save long after they have been paid for. An economically rational energy conservation program therefore has the potential to provide some of the highest returns on investment at the present time.

COMMERCIAL AND INDUSTRIAL BUILDINGS

REFER ALSO TO CITATION(S) 6093, 6917, 6923, 7033, 7034, 7035, 7041, 7042

7045 Part load efficiency advantages of two-speed refrigerant compressors. Cawley, R.E.; Pfarrer, D.M. (Lennox Industries Inc., Fort Worth, TX). pp 42-46 of In Proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Goldschmidt, V.W.; Didion, D. (eds.). Lafayette, IN; Purdue Research Foundation (1974).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P1.

Air conditioning equipment in light commercial applications is sized to meet peak cooling load conditions, but must often operate at a lower cooling capacity level. While common methods used for unloading air conditioner compressers have satisfied comfort demands, they do result in lower compressor operating efficiency. The operation and performance of 2-speed motor compressors which are even more efficient in the unloaded mode than in the loaded mode are described. Test results showed that the 2-speed motor will consume considerably less energy in meeting full- and half-load cooling requirements than will other compressor unloading methods. (LCL)

TRANSPORTATION

REFER ALSO TO CITATION(S) 6927, 6975

LAND AND ROADWAY

REFER ALSO TO CITATION(S) 6924

PIPELINE

REFER ALSO TO CITATION(S) 6961

INDUSTRY AND AGRICULTURE

REFER ALSO TO CITATION(S) 6865, 6885, 6888, 6902, 6908, 6912, 6927

ENERGY SOURCES

REFER ALSO TO CITATION(S) 5779, 6598, 6867, 6920, 6974, 6975, 6976, 6978

7046 Effect of the increase in size of the production units of the steel industry on energy supply, time dependent fluctuations in energy procurement and consumption. Risse, W.; Hoffmann, G.W.; Poettken, H.G.; Seeger, M. *Stahl Eisen;* **97**: No. 10, 504-514(19 May 1977). (In German and French).

The interests of the energy suppliers and the needs of the steel industry are increasingly developing in opposite directions. The energy suppliers are interested in steady sales. The energy requirements of the steel plants are characterized by nonuniformity. The supply of blast furnace top gas is subject to increasing fluctuation, because of the steadily increasing size of the production units. Cases of supply and demand fluctuations and remedies used are discussed on the following examples: fluctuations of quantity and pressure in the blast furnace gas economy; use of converter gas and waste heat steam in basic oxygen steelmaking; effect of high duty reheating furnaces on the rich gas economy; and electric power and oxygen economies.

MATERIALS

7047 (NP—22498) **Lime-fly ash-aggregate mixtures in pavement construction.** Barenberg, E.J. (National Ash Association, Washington, D.C. (USA)). [nd]. 56p. Ash Association, Inc., Washington, DC.

During the past 20 years there has been a steady growth in the use of lime fly ash aggregate (LFA) mixtures as paving materials. The basic components of such mixtures are 75 to 90% aggregates, 8 to 20% flyash, and 2 to 5% hydrated lime. These materials have proven to be highly durable and given good performance in service. With the recent shortages in such conventional paving materials as asphalt and Portland cement, the concern for our environment, and recent urging by the Federal Highway Administration to maximize the use of by-product materials in pavement construction, the use of LFA mixtures should increase at an even faster pace. The current state of the art of the technology and use of LFA mixtures is discussed with descriptions of: the components and the engineering properties of LFA mixtures; the behavior and performance of pavements with LFA mixtures; the production and placement of LFA mixtures; and some of the current practices in the use of LFA mixtures.

EQUIPMENT AND PROCESSES

REFER ALSO TO CITATION(S) 6522, 6546, 6976, 6978, 7073

7048 (DPSP—77-55-100-K) **Site survey: Area 100-K.** Hardin, T.C.; Colven, J.D. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Plant). Aug 1977. Contract EY-76-C-09-0001. 25p. Dep. NTIS, PC A02/MF A01.

The results of a site energy survey and appraisal of Area 100-K, which includes a nuclear reactor facility, are presented. This site is located in the Savannah River Plant near Aiken, S. C. Appropriate manuals and guidelines published by ERDA were used for the survey and appraisal. The survey period was for one year, July 1, 1975, to June 30, 1976. Area 100-K contains a steam-electric power plant which generates process steam and part of the electricity required by the area. Incoming energy includes: purchased electricity, river cooling water, with offsite pumps and electric motors, diesel fuel oil, and coal for the power plant. The results show the total cost of purchased energy [coal, electricity (including river cooling water pump motors), and diesel fuel oil] is $8,548,000 per year.

7049 (DPSP—77-55-184-K) **Building survey: Building 184-K powerhouse.** Hardin, T.C.; Colven, J.D. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Plant). Aug 1977. Contract EY-76-C-09-0001. 40p. Dep. NTIS, PC A03/MF A01.

The results of a building energy survey of Building 184-K powerhouse, which serves an area including a nuclear reactor facility, are given. This facility is located in the Savannah River Plant of the Energy Research and Development Administration near Aiken, S. C. Appropriate manuals and guidelines published by ERDA were used for the survey and appraisal. The survey period was for one year, July 1, 1975, to June 30, 1976. Process steam and part of the electricity required by Area 100-K are generated by the Building 184 powerhouse. Based on total heat input, potential savings in Building 184 powerhouse through use of five of the energy-saving recommendations analyzed equal 236.5 x 10^9 Btu per year or $288,030 per year. These recommendations are concerned with: heat losses due to unaccounted for and "blown" steam; heat loss due to nonreturn of process steam condensate; heat loss due to low boiler efficiency; loss of turbine work due to high condenser pressure; and energy loss due to using electric motors to drive boiler feed pumps.

7050 (TID—27600) **Maintenance and adjustment manual for natural gas and No. 2 fuel oil burners.** (Federal Power Commission, Washington, D.C. (USA). Bureau of Natural Gas). 1977. 52p. Dep. NTIS, PC A04/MF A01.

With the nation facing fuel shortages, there is considerable interest in various techniques for conserving fuel. Fuel savings of 10 to 30% appear likely when burner equipment is properly adjusted and maintained. This manual is intended as a practical contribution to bring about greater energy efficiency by describing adjustment and measurement procedures for some natural-gas and No. 2 fuel-oil burners. Because of the many variations among burner types, details peculiar to individual installations cannot be included. It is assumed that burner manufacturers' specifications are being followed by those maintaining burners. For safety reasons one should never undertake a burner adjustment without proper training according to burner manufacturers' specifications. This manual is directed toward answering the following three questions: does burner adjustment increase efficiency and reduce fuel consumption without sacrificing production; how can one determine whether a system is operating efficiently or whether it is wasting, sometimes, substantial amounts of fuels; and what adjustments must be made after a system has been found to be operating inefficiently.

7051 Insulation of crucible-type induction furnaces. Feldhus, H.G. *Giessereipraxis;* No. 4, 50-54(25 Feb 1977). (In German).

The applicability of various currently available high-temperature thermal insulating materials for use in the area between the induction core and the ceramic crucible in crucible-type induction furnaces is examined. The design and thickness of the insulation layer for achieving optimum thermal efficiency is discussed in detail. 3 refs.

7052 Steam trapping. Webb, T. (Yarway Ltd., Perthshire, Scotland). *Int. J. Energy Res.;* **1**: No. 2, 179-185(1977).

Faults in steam trapping are wasting money and high-grade energy in industrial installations. A steam trap survey in facilities with more than 500 traps will probably locate some significant steam losses. Steam loss may occur through trap failure or through the installation of wrongly-sized traps. The flow capability method used for estimating steam loss is described. The technique using visual and aural observation and temperature measurement for surveying steam traps is also described. Finally, a list of application errors is presented.

WASTE HEAT RECOVERY AND UTILIZATION

REFER ALSO TO CITATION(S) 6905

7053 (ORNL-tr—4385) **Utilization of waste heat from nuclear power plants.** Balligand, P. (CEA, 75 - Paris (France)). 1977. Translation of French report. 9p. Dep. NTIS, PC A02/MF A01.

The utilization of waste heat from French nuclear power plants in forestry, open field agriculture, aquaculture, and in the space heating of greenhouses and city buildings is examined in terms of technical feasibility, cost, and the potential fuel savings from such waste heat uses. (LCL)

INDUSTRIAL WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 6861, 7047

7054 Sulfur dioxide reduction. Daley, W.D. (to Allied Chemical Corp.). US Patent 4,039,650. 2 Aug 1977. Filed date 10 May 1976. 14p.

Sulfur dioxide is reduced to sulfur and hydrogen sulfide with a gaseous reducing agent in the presence of a catalyst. The process involves mixing a sulfur dioxide-containing gas stream with a portion of the gaseous reducing agent and passing the resulting mixture through a reactor to effect reduction of a portion of the sulfur dioxide to hydrogen sulfide and sulfur, mixing the gas stream from the reactor with the remaining gaseous reducing agent, and splitting the resulting mixture into two gas streams which are in parallel passed through a second and third reactor to effect reduction of sulfur dioxide to form hydrogen sulfide and sulfur. Periodically, the flow in the first and third reactors is reversed to thereby subject these reactors to periodically alternating heat absorbing and desorbing cycles while the flow in the second reactor is always maintained

in the same direction. Inlet gas temperatures to the second and third reactors are maintained within desired ranges by by-passing a portion of the sulfur dioxide-containing gas-steam and reducing agent around the first reactor.

7055 Bleach plant filtrate recovery. Reeve, D.W.; Rowlandson, G.; Rapson, W.H. (to Erco Envirotech Ltd.). US Patent 4,039,372. 2 Aug 1977. Priority date 11 Mar 1975, United Kingdom of Great Britain and Northern Ireland (UK). 14p.

Acid and alkaline filtrates are separated from the bleach plant of a bleached pulp mill for use in washing unbleached pulp free from entrained pulping liquor. Acid effluent is neutralized with sodium hydroxide solution prior to use in the washing as the last washing step while alkaline filtrate is used in the remainder of the washing. Part of both the acid and alkaline filtrates are not used in the washing to allow bleed of calcium value and caustic extraction stage solids which otherwise would build up on the washed pulp mat passing to the bleach plant.

MUNICIPALITIES AND COMMUNITY SYSTEMS

REFER ALSO TO CITATION(S) 6901

PUBLIC UTILITIES

7056 Natural gas: energy for heating and district heat supply. Bulnhein. *Energiewirtsch. Tagesfragen;* **26**: No. 6, 264-274(Jun 1976).

As an introduction, the production sources of district heat are listed and the advantages and limitations of heat-power coupling are discussed. The author then proceeds to discuss the use of gas (natural gas) as energy for heating and points out the difference between gas and district heat supply. Transport costs are given for heat carried in the heating water and bound in the gas. The combined use of gas and oil or coal in district heating is discussed, and the phase shift of the demand for space-heating heat and peak heat generation are discussed in the last chapter.

MUNICIPAL WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 6861

7057 (BNL—50690) **Development of a glass polymer composite sewer pipe from waste glass. Progress report No. 4, April—June 1977.** Kukacka, L.E.; Fontana, J.; Sugama, T.; Rayfiel, R.; Arnold, G.; Galen, B. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 16p. Dep. NTIS, PC A02/MF A01.

Large quantities of energy can be conserved by recycling municipal solid waste. Reductions in the costs associated with waste disposal such as by landfilling can also be accrued. While uses for recycled ferrous and non-ferrous metals are apparent, uses for the glass fraction which constitutes approximately 10% of municipal solid waste, have not been developed. As a result, a program to develop methods for incorporating waste glass into composites which can be used for construction materials was started in July 1976. Since that time the properties of glass polymer sewer pipe have been measured and field testing of full-scale specimens has been initiated. To date, the results indicate that high-strength durable materials can be produced. Conservative estimates indicate that the energy value for glass polymer pipe is up to 16% less than that for vitrified clay pipe. Work accomplished during the period April 1 to June 30, 1977 is described.

7058 (CONS/2482—1) **Federal involvement in: municipal wastewater treatment plant sludge energy recovery and conservation.** (Stanley Consultants, Washington, D.C. (USA)). Jun 1977. Contract EA-77-X-01-2482. vp. Dep. NTIS, PC A03/MF A01.

The results are presented of a study concerning federal involvement in municipal wastewater treatment plant (MWWTP) sludge energy recovery and conservation. The objectives of the study were to: determine and report the major agency programs and related MWWTP sludge energy recovery and conservation projects; determine and summarize the coordination efforts between federal agencies involved in MWWTP sludge; and recommend future U.S. Energy Research and Development Administration (ERDA) involvement in MWWTP sludge energy recovery and conservation projects. Specific federal agencies designated for surveying include ERDA, EPA, USDA, Bureau of Mines, National Science Foundation, and National Commission on Water Quality. Past (post-1966), present, and planned federal involvement in MWWTP sludge energy recovery and conservation, research and development, demonstration, and study projects were considered.

ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

7059 (UCRL—79523) **Preliminary design of a subscale ceramic helical-rotor expander.** Mohr, P.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Aug 1977. Contract W-7405-ENG-48. 15p. (CONF-770380—1). Dep. NTIS, PC A02/MF A01.

From 5. army materials technology conference; Newport, Rhode Island, USA (21 Mar 1977).

A program was undertaken to develop a class of fuel-tolerant ceramic expansion engines believed to have the potential for operating reliably and efficiently on the unmodified combustion products of coal. Such engines, operating essentially uncooled at temperatures in excess of 1350°C, appear attractive for original and retrofit applications in automotive, propulsion, industrial, and especially topping-cycle service for central power stations. The demonstration of a first small-scale (125-mm rotor diameter) ceramic helical-rotor expander has been identified as an early and feasible program goal. Design concepts and preliminary designs being considered for the prototype are described. In addition to expander design, the initial program includes consideration of the key questions of expander performance, combustion-product tolerence, materials and component evaluation and development, along with planning for development to intermediate (600-mm) and power-station-scale (1600-mm) applications. Progress in these and other programatic aspects is summarized briefly.

7060 Seventh annual fairey lecture: the better conservation of liquid fuels for mobile use. Pitchford, J.H. (Ricardo and Co, Shoreham-by-Sea, Sussex, Engl). *J. Sound Vib.;* **47**: No. 3, 371-385(8 Aug 1976).

Light distillate liquid fuels have self-evident qualities for mobile use. It is therefore incumbent upon us not to squander such fuels in applications where heavier and less costly fuels can be used. In considering the most economical fuel for automotive use, consideration must always be given to the energy required in its production in the refinery: gasoline and gas oil are compared. Various fuels and a variety of types of prime movers and their potentials are reviewed as regards their advantages and disadvantages, and consideration is given to the urgent national importance of a program of R and D work aimed specifically at the parallel and complementary optimization on economic grounds of possible fuels and engine types so that, looking ahead ten to twenty years, the greatest work output may be achieved from the lowest energy input. Consideration is also given to overall "fuel to wheel" efficiency as influenced by the engine/transmission relationship.

INTERNAL COMBUSTION ENGINES

7061 Measurements of the spatial distribution and engine speed dependence of turbulent air motion in an I.C. engine. Witze, P.O. Warrendale, PA; Society of Automotive Engineers, Inc. (1977). 16p. (CONF-770205—77).

From Conference of the SAE International Automotive Engineering Congress and Exposition; Detroit, Michigan, United States of America (USA) (28 Feb 1977).

A hot-wire anemometer was used to study the air motion in a motored I.C. engine. Measurements were made of the mean velocity, turbulence intensity, and integral scales of turbulence. The engine speed was varied from 500 to 2500 rpm, and the hot-wire probe was traversed both across the combustion chamber clearance volume and down into the piston sweep volume. The latter traverse was accomplished by probe-accommodating "wells" built into the piston crown, which were subsequently shown to severely disrupt the flow during the compression and expansion strokes. The results show the mean velocity and turbulence intensity to vary linearly with engine speed, and the turbulence scales to be a function of geometry only. The structure of turbulence was found to be inhomogeneous in the clearance volume and the upper portion of the sweep volume.

SPARK-IGNITION

REFER ALSO TO CITATION(S) 7074

TURBINE

REFER ALSO TO CITATION(S) 7073

EXTERNAL COMBUSTION ENGINES

STIRLING CYCLE

REFER ALSO TO CITATION(S) 7073

7062 (COO—2631-21) **80- to 100-hp Stirling engine feasibility study. Progress report No. 21, January—March 1977.** Postma, N.D. (Ford Motor Co., Dearborn, Mich. (USA)). 1977. Contract EY-76-C-02-2631. 5p. Dep. NTIS, PC A02/MF A01.

Ford Motor Company has sponsored research and development of a 170 hp swashplate-type of Stirling engine suitable for application to a passenger car having a curb weight in the neighborhood of 4,600 pounds. The success of this program has justified the need for investigating the application of the Stirling engine to passenger vehicles of smaller size and lighter weight. Progress is reported for the research program which has two tasks. Task I provided for preparation of a report containing an evaluation and presentation of the results of Contractor-financed testing of a Torino passenger car powered by a 170 hp Stirling cycle engine. Task II provides for a feasibility study to evaluate the potential of a Stirling cycle engine for significant improvements in emissions and fuel economy over the present day internal combustion engine, and to develop a concept of an 80 to 100 hp engine design suitable for use in a passenger car in the 2500 to 3000 lb. weight class. The ultimate objective of this and other Ford programs is to develop technology to determine whether it is reasonable to undertake a high volume Stirling engine production program.

ELECTRIC-POWERED SYSTEMS

REFER ALSO TO CITATION(S) 6271, 6838, 6839, 6840, 6841, 6842, 6843

7063 (LR—631) **Review of market prospects for battery electric road vehicles. 2.** Porter, J.; Briggs, M. (Transport and Road Research Lab., Crowthorne (UK)). 1974. 41p. .

Details of an economic assessment of market prospects for battery electric road vehicles and some of the more important conclusions are presented. The most likely markets for battery electric road vehicles are identified as the light-goods vehicle and some urban buses. Only the advent of a high-energy-density battery, like sodium—sulfur, is likely to make consideration of the battery electric passenger car worthwhile.

7064 (SAN/1213—1) **Near-term electric vehicle program: Phase I, final report.** Rowlett, B.H.; Murry, R. (AiResearch Mfg. Co., Torrance, Calif. (USA)). Aug 1977. Contract EY-76-C-03-1213. 266p. Dep. NTIS, PC A12/MF A01.

A final report is given for an Energy Research and Development Administration effort aimed at a preliminary design of an energy-efficient electric commuter car. An electric-powered passenger vehicle using a regenerative power system was designed to meet the near-term ERDA electric automobile goals. The program objectives were to (1) study the parameters that affect vehicle performance, range, and cost; (2) design an entirely new electric vehicle that meets performance and economic requirements; and (3) define a program to develop this vehicle design for production in the early 1980's. The design and performance features of the preliminary (baseline) electric-powered passenger vehicle design are described, including the baseline power system, system performance, economic analysis, reliability and safety, alternate designs and options, development plan, and conclusions and recommendations. All aspects of the baseline design were defined in sufficient detail to verify performance expectations and system feasibility.

7065 (SAN/1294—1) **Near-term electric vehicle program: Phase I, final report.** (General Electric Co., Schenectady, N.Y. (USA)). Aug 1977. Contract EY-76-C-03-1294. 161p. Dep. NTIS, PC A08/MF A01.

The work included in the Final Report given is part of the Electric Car Program undertaken by the U.S. Energy Research and Development Administration. The goal of the ERDA program is to develop by 1979 a totally new electric car with substantially improved performance over those electric cars available in 1976. The rationale used in designing a four-passenger electric car for use in an urban environment is presented. The program reported was undertaken by the General Electric Company as prime contractor with Triad Services, Inc., as a subcontractor. The approach taken was to design an electric car utilizing current technology. On the basis of tradeoff analyses, upgrading improvements were identified which would permit the electric car to more nearly meet all of the ERDA near-term goals. A summary is given of the electric car design, including the chassis, drive train, major components, and the control. The Phase I electric car design will meet many of the ERDA near-term goals. Upgrading development programs are identified which, when incorporated in Phase II vehicle development, will result in upgraded performance, which essentially meets ERDA's near-term goals.

7066 (UCRL—79155) **Systematic approach to the evolution of high performance electric vehicles.** O'Connell, L.G.; Cooper, J.F.; Miller, A.B.; Newkirk, H.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Jan 1977. Contract W-7405-ENG-48. 42p. (CONF-770430—1). Dep. NTIS, PC A03/MF A01.

From 4. international symposium on automotive propulsion systems; Washington, District of Columbia, United States of America (USA) (17 Apr 1977).

The performance characteristics of current and future electric vehicles are examined and compared to projected heat engine vehicle parameters. The shortcomings of electric vehicles in the near-term time frame are discussed. It is predicted that the all-electric vehicle will not gain wide acceptance in the near future because of degraded performance characteristics. Because the near-term low-acceptance level of electric vehicles is caused by their overall lower performance level, a hybrid concept is examined which the authors believe can give an enhanced performance level in the short-range future. This type of vehicle is proposed as a much needed transition system to provide an evolutionary change from the heat-engine system vehicle of today to electric vehicles with acceptable performance in the future.

7067 **Airport passenger vehicle on trails.** *Electr. Veh. [8]London[9]*; **62**: No. 2, 22(Jun 1976).

Many of the short-range, restricted-speed duties carried out on airports all over the world ideally could be done by battery electric vehicles. In the Spring of 1976, Smith's Electric Vehicles, Ltd., displayed at the Fifth World Airports Exhibition in Brighton, Sussex, a passenger-carrying vehicle destined later for trials at Teeside Airport, Darlington. It will be used to carry passengers between the terminal building and the railway station, a distance of about 1,100 yards within the airport site. Carrying 10 to 12 passengers, the vehicles have a maximum operating speed on the level of approximately 20 mph (32 km/h) and an operating range of between 60 and 70 miles per battery charge, which can be extended by taking advantage of any inactive period during a tour of duty to recharge from the Chloride-Legg Spegel charger. The battery is of 36 cells, 441 A/h capacity and is easily accessible through removable panels and by lifting the seats.

7068 **Electricity Council starts to assess the Enfield 8000.** *Electr. Veh. [8]London[9]*; **61**: No. 3, 8-11(Sep 1975).

The Electricity Council has, during the past few months, taken delivery of 61 Enfield 8000 electric city cars. Manufactured by Enfield Automotive, Ltd., Cowes, Isle of Wight, the cars are being distributed by the Council to Electricity Boards in England and Wales, who will carry out a large-scale operational research program covering the performance and use of the vehicles. Particular attention is to be paid to the effect of different charging routines. The research is expected to take about two years to complete; the cars will therefore be tested under a full range of operating conditions. The Enfield 8000 is a 9 ft, 4 in.-long, two-passenger closed car with a curb weight of 2150 lb and a payload of 350 lb. Traction power and energy for a 600-W heater are supplied by eight 12-V lead—acid batteries of 92 Ah capacity at the 5-h rate, connected in parallel pairs to give 48 V maximum. An auxiliary 12-V battery (55 Ah) supplies control circuits, lights, horn, windshield wipers, etc. A built-in battery charger enables the traction batteries to be fully recharged in eight hours from a standard domestic 13-A socket if the discharge does not exceed 80 percent. The traction motor is 48 V, 6 kW dc four-pole series type, giving 8 hp at maximum speed. The maximum vehicle speed is 40 mph on the level; acceleration from 0 to 30 mph takes about 13 s. Maximum range is about 50 mi.

7069 **Lucas bus is on evaluation trials.** *Electr. Veh. [8]London[9]*; **61**: No. 1, 3-6(Mar 1975).

The first electric bus in regular daily service in an English city went into operation in Manchester on 28 February 1975. Using a sophisticated lead—acid battery developed by Lucas (Batteries), Ltd., the bus is described as having a performance comparable to a Diesel vehicle and is said to have done journeys of over 100 miles on one battery charge during trial runs. The bus is a 34-passenger midibus with a composite light-alloy, glass-fiber body. Powered by a 360-volt dc motor, which develops 130 brake horsepower, mounted in the center of the chassis, a propeller shaft drives the conventional back axle; the motor is controlled by a Lucas-designed SCR "chopper" located at the rear of the bus. Additional solid-state circuitry automatically adjusts the power to the motor so that it is appropriate to the accelerator pedal position set by the driver and the vehicle speed. The Lucas bus with a full complement of passengers can accelerate smoothly from 0 to 30 mph in under 15 seconds, while a top speed of more than 45 mph is available.

HYBRID SYSTEMS

REFER ALSO TO CITATION(S) 7066, 7071

7070 (UCRL—13757) **Hydraulic accumulators for hybrid automobiles and transport vehicles.** Miller, J.; Rasmussen, R. (Honeywell, Inc., Minneapolis, Minn. (USA). Energy Resources Center). 26 Jun

1977. Contract W-7405-ENG-48. 108p. Dep. NTIS, PC A06/MF A01.

A final report is given covering a three-month effort to study and document mechanical energy storage through the use of hydraulic accumulators for hybrid automobiles and transport vehicles. The study covered the energy storage capacity range of 0.06 to 2.5 KWh formation provided by the study includes an estimate of energy storage densities, power densities and efficiencies which are achievable, both for near-term and future applications. In addition, a driveability criteria is defined and an estimate of presently obtainable performance (58 mpg urban, 38 mpg suburban) for a 3220 lb (100 slug) automobile was developed.

FLYWHEEL PROPULSION

7071 (DOT-TST—77-21) **Increased fuel economy in transportation systems by use of energy management. Third year's program. Final report, May 1, 1976—July 1, 1976.** Beachley, N.H.; Frank, A.A. (Wisconsin Univ., Madison (USA). Engineering Experiment Station). Jul 1976. 85p. NTIS.

A report is given of the results accomplished during the third year of a three-year research program, the overall goal of which has been to conceive and evaluate practical ways to increase automobile fuel economy by energy management within the engine-transmission-vehicle system. The third year was devoted primarily to the detailed design, construction, and preliminary evaluation of a Flywheel Energy Management Powerplant (FEMP) installed in a Pinto. The vehicle has been built to experimentally verify performance simulations and to allow the practical aspects of a real flywheel vehicle to be studied. The FEMP consists basically of an internal combustion engine, a high-speed energy-storage flywheel, and a hydrostatic power-split continuously-variable transmission (CVT) system. The flywheel drives the car, and the engine comes on to "recharge" it (with efficient wide-open throttle operation) only when the flywheel speed drops below a predetermined value. The concept also permits effective and efficient regenerative braking. Computer simulations have indicated an improvement in city fuel mileage of about 50%, with improvements of 100% appearing feasible with further research. Preliminary testing of the car shows favorable performance.

VEHICLE DESIGN FACTORS

ENGINE SYSTEM

REFER ALSO TO CITATION(S) 7070

7072 (BERC/RI—77/9) **Valve timing: its effect on emissions and fuel economy.** Bechtold, R.L.; Marshall, W.F. (Energy Research and Development Administration, Bartlesville, Okla. (USA). Bartlesville Energy Research Center). Aug 1977. 15p. Dep. NTIS, PC A02/MF A01.

The effects of valve timing on exhaust emissions and fuel consumption were investigated experimentally. Emission control through the use of varied valve timing compared to conventional emissions control hardware was documented along with the effects of valve timing on emissions. Fuel consumption trends with changed valve timing were determined. The engine design of the test vehicle allowed independent adjustment of intake and exhaust valve timing. Emissions and fuel consumption were determined for steady-state speeds of 20 through 60 mph in 10 mph increments. A wide variety of intake and exhaust valve timing combinations were tested and the results compared to those of the production vehicle before modification. These results showed that valve timing has a significant effect on oxides of nitrogen emissions, but additional emissions control hardware is necessary to meet current and proposed emission regulations. Compared to emission control, varied valve timing holds more promise for reduced fuel consumption through a gain in cycle efficiency at various speeds.

7073 (COO—2630-18) **Automotive gas turbine ceramic regenerator design and reliability program. Final annual report, July 1, 1975—September 30, 1976.** Cook, J.A.; Fucinari, C.A.; Lingscheit, J.N.; Rahnke, C.J. (Ford Motor Co., Dearborn, Mich. (USA)). Oct 1976. Contract EY-76-C-02-2630. 290p. Dep. NTIS, PC A13/MF A01.

The primary objective of the ERDA/Ford Ceramic Regenerator Design and Reliability Program is to develop ceramic regenerator cores that can be used in passenger car gas turbine engines, Stirling engines, and industrial/truck gas turbine engines. Specific durability objectives are defined as achieving a B_{10} life of 10,000 hours on a truck/industrial gas turbine engine duty cycle. Previous reports, under this program, summarized operating experience on lithium aluminum silicate (LAS) ceramic regenerator cores obtained at Ford Motor Company. The primary cause of failure of these regenerators was determined to be chemical attack of the LAS material. Improved materials and design concepts aimed at reducing or eliminating chemical attack were placed on durability test in Ford 707 industrial gas turbine engines late in 1974. A description is given of the results of 18,500 hours of turbine engine durability testing accumulated during the period from July 1, 1975 to Sept. 30, 1976. Two materials, aluminum silicate and magnesium aluminum silicate continue to show promise toward achieving the durability objectives of this program. Regenerator cores made from aluminum silicate show no evidence of chemical attack damage after 5600 hours of engine test.

7074 (SAND—75-8283) **Dynamic analysis for the Pouliot Variable Displacement Engine.** Delameter, W.R. (Sandia Labs., Albuquerque, N.Mex. (USA)). Oct 1975. Contract EY-76-C-04-0789. 64p. Dep. NTIS, PC A04/MF A01.

The piston and the three connecting links in the Pouliot Variable Displacement Engine are dynamically analyzed. Given the cylinder pressure as a function of the crank angle, the internal member and bearing loads are determined, as well as the unbalanced forces due to the reciprocating masses. Friction forces which result in approximate power losses are included. The unbalanced forces are closely examined, and it is shown that a five-cylinder in-line design is the best choice for the prototype engine to be built at Sandia Laboratories, Livermore.

7075 **Scanning electron microscope studies of copper—lead bearing corrosion.** Weetman, D.G.; Kreuz, K.L.; Hellmuth, W.W.; Becker, H.C. St. Louis; Society of Automotive Engineers, Inc. (1976). 6p. (CONF-760678—21). .

From Meeting of the Society of Automotive Engineers on combined fuels and powerplant; St. Louis, Missouri, United States of America (USA) (8 Jun 1976).

Scanning Electron Microscopy is a highly effective tool for characterizing the types of corrosion experienced by the surface of copper-lead connecting rod bearings from the CLR engine L-38 Test. Results indicate that the initial corrosive attack on these surfaces is preferentially upon lead; subsequent attack is upon lead and/or copper. Although ethylene dibromide and ethylene dichloride fuel scavengers contribute to corrosion, the presence of halogen on after-test bearing surfaces is not necessarily associated with high bearing weight loss. The effect of ashless dispersants, alkaline detergents and zinc dithiophosphates on bearing corrosion was also investigated. No relationship was found between additive performance and the generation of additive-derived films on bearing surfaces.

NITROGEN OXIDES

REFER ALSO TO CITATION(S) 7072

CARBON MONOXIDE

REFER ALSO TO CITATION(S) 7072

HYDROCARBONS

REFER ALSO TO CITATION(S) 7072

ALTERNATIVE FUELS

7076 (CONS/4707—1) **Hydrogen-fueled railroad motive power systems: a feasibility study.** Foster, R.W.; Escher, W.J.D. (Escher Technology Associates, St. Johns, Mich. (USA)). Sep 1976. vp. Dep. NTIS, PC A12/MF A01.

Under U.S. Energy Research and Development Administration sponsorship, and as part of its transportation energy conservation activity, a special assessment of prospects for railroad-system use of hydrogen fuel was conducted in the summer of 1976. Based on contacts with railroad organizations and individuals in government, industry, and research organizations, the feasibility and desirability of converting conventional diesel-electric locomotives to hydrogen operation were evaluated. Such a step is shown to be technically feasible and would provide another alternative—in addition to hydrocarbon synthetic fuels and railway electrification—for moving U.S. railroad systems away from today's near total dependency on petroleum. Environmental benefits would also accrue. The study report provides (1) the overall rationale for developing hydrogen railroad motive power systems, (2) an assessment of technical feasibility, and (3) a nominal development and demonstration program plan.

MATERIALS

7077 (ERDA—77-123) **Materials Sciences Programs.** (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Basic Energy Sciences). 1977. 139p. Dep. NTIS, PC A07/MF A01.

A compilation and index of the ERDA materials sciences program is presented. This compilation is intended for use by administrators, managers, and scientists to help coordinate research and as an aid in selecting new programs. (GHT)

METALS AND ALLOYS

REFER ALSO TO CITATION(S) 6604, 7120

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 5978, 6691, 7082

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 7088, 7170

7078 (UCRL-Trans—11253) **Metallurgical study of alpha and gamma phase forging of uranium-0.2 percent vanadium alloy.** Linard, M.; Prunier, C.; Meuriot, R.; Giraud-Heraud, F. Translated from *Mem. Sci. Rev. Metall.;* **73**: No. 6, 435-447(Jun 1976). 25p. Dep. NTIS, PC A02/MF A01.

Grain refinement of the U-0.2 pct V alloy is now being accomplished by controlled cooling from the β-phase. By this method the refinement is limited, and the mechanical properties cannot be further improved thereby. Working of the alloy (forging, stamping, rolling) could be beneficial; but, after forging in the γ phase, a thermal refining treatment (1 h at 720°C, cooling at 10° C/mn) remains necessary in order to obtain a fine-grained structure (70 to 80 μm). On the other hand, forging in alpha phase leads directly to a partially recrystallized structure formed for the most part of very fine grains, the size and proportion of which vary with the temperature of forging. The state of recrystallization obtained after forging at temperatures higher than 580°C was not modified by subsequent isothermal annealings in the α phase, but for the alloy worked at 500°C one could perceive changes in the microstructure from annealing. These changes were exhibited by growth of recrystallized grains accompanied by a spheroidization of the precipitates. If for all the materials resulting from forging at various temperatures plus thermal treatment by continuous cooling from the β-phase, the properties are similar [as they are for low C alloys], then after forging and annealing, both being done in the α-phase, the elongation to rupture is able to exceed 40 pct. On the other hand, in case of the alloys with a high carbon content, it is also possible to improve the mechanical properties by thermo-mechanical treatment in α-phase, but the usual thermal treatments are shown to be completely ineffectual [at least at this level of vanadium]. So, it appears that, contrary to working in γ phase which only serves as a simple operation for shaping, working in the α-phase allows one to deeply modify the structure and to improve the ductility of the alloy.

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 6607, 6609, 6621, 6661, 7097

7079 (COO—3084-53) **Combined macroscopic and microscopic approach to the fracture of metals. Technical progress report, July 1976—June 1977.** Gurland, J.; Rice, J.R.; Asaro, R.J.; Needleman, A. (Brown Univ., Providence, R.I. (USA). Dept. of Engineering). Jul 1977. Contract EY-76-S-02-3084. 21p. Dep. NTIS, PC A02/MF A01.

The work includes the completion of a comprehensive study of the contributions of dislocation substructures and local stresses at particle interfaces to the strain hardening of dispersion hardened steels, and the presentation of a model of segregant induced embrittlement of grain interfaces. Work was continued on crack initiation at inclusions and on the theory of plastic flow localization. These microscopic effects are discussed in relation to the mechanisms of brittle fracture and ductile rupture of metals and alloys. On a more macroscopic scale, the state of stress and strain associated with the large plastic deformation at a crack tip was further defined based on finite element and slip line calculations, and some preliminary results were obtained by finite element methods for stable crack growth under plane strain conditions. A new finite element method has been developed for fully plastic flow under plane strain conditions.

7080 (GA-A—14111) **Alloy 800 for nuclear reactor applications.** Roberts, D.I. (General Atomic Co., San Diego, Calif. (USA)). Jun 1977. Contract EY-76-C-03-0167-050. 32p. Dep. NTIS, PC A03/MF A01.

Alloy 800 is currently used in both water-cooled and high-temperature gas-cooled reactors and has the potential for use in future more advanced systems. In this article the current state of the relevant alloy technology is briefly reviewed. It is concluded that the potential benefits of Alloy 800 can be attained through development of an improved data base and by the acquisition of more extensive use experience with the alloy in high-temperature reactor service.

7081 (LA-UR—77-1875) **Some microstructures developed in 303 stainless steel which has been shock loaded to the megabar range.** Sandstrom, D.J.; Jones, T.I. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 14p. (CONF-770738—1). MF A01.

From Workshop on rapid solidification; La Jolla, California, USA (11 Jul 1977).

A solid sphere of 303 stainless steel was subjected to a multimegabar shock pressure in a spherically convergent high explosive system. The recovered stainless steel wall was subjected to a metallurgical examination to determine the microstructural features developed in the ball. The most recent examination was prompted by the desire to determine whether the solidification rates developed in the ball (estimated to be 10^8 to 10^{10} K/sec by the pressure release in the trailing edge of a shock were actually developed. The cooling rate determinations were to be made by observing the dendrite arm spacing (DAS) developed in the solidified metal. The examination reported in this paper has yielded inconsequential results regarding the cooling rate. Estimates of dendrite arm spacing were made and a solidification rate of greater than 10^4 K/sec was estimated. The alloy used in this experiment, 303 stainless steel, is chemically too complex to develop easily interpreted results. We intend to repeat these experiments using simpler binary alloys and pure metals.

7082 (LBL—5770) **Liquid phase sintering of iron with copper base alloy powders.** Chen, M.H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1976. Contract W-7405-ENG-48. 43p. Dep. NTIS, PC A03/MF A01.

Thesis.

The physical and mechanical properties of a series of atomized elemental Fe and prealloyed Fe + Cu powders blended with different amounts of liquid phase additions were studied in the as-sintered condition. The alloy of 88 percent Cu, 3 percent Mn, 9 percent Si was found to have superior characteristics for use as a liquid phase material in the sintering of elemental Fe or its prealloyed powders. The effects of additions of this alloy on the sintered density, tensile strength, transverse rupture strength and hardness were determined and compared with other reported results. The sintering mechanism and swelling effect did not conform with conventional theories. Some recommendations are made for further studies in liquid phase sintering of ferrous systems.

7083 (ORNL—5285) **Use of ultimate tensile strength to correlate and estimate creep and creep-rupture behavior of types 304 and 316 stainless steel.** Sikka, V.K.; Booker, M.K.; Brinkman, C.R. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 96p. .

Elevated-temperature tensile and creep properties of several heats of types 304 and 316 stainless steels were used to show that the short-term ultimate tensile strength of a given heat at the creep-test temperature and at a fixed strain rate can be used as an index for correlating and predicting creep and creep-rupture behavior. The short-term elevated-temperature ultimate tensile strength helps to account for changes in creep properties due to test temperature as well as due to heat-to-heat variations. Generalized models of time to rupture and minimum creep rate were defined in terms of stress, temperature and ultimate tensile strength. Ultimate tensile strength was used in a creep equation to predict the strain-time behavior of individual heats. Several possible reasons are presented for the observed relationships between the short-term ultimate tensile strength and the long-term creep properties. Design and materials engineering implications of the observed relationships between short-term elevated-temperature ultimate tensile strength and creep properties are also discussed.

7084 (ORNL—5293) **Substructures developed during creep and cyclic tests of type 304 stainless steel (heat 9T2796).** Swindeman, R.W.; Bhargava, R.K.; Sikka, V.K.; Moteff, J. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 36p. Dep. NTIS, PC A03/MF A01.

Substructures developed in tested specimens of a reference heat of type 304 stainless steel (heat 9T2796) are examined. Data include dislocation densities, cell and subgrain sizes, and carbide precipitate sizes. Testing conditions range for temperatures from 482 to 649°C, for stresses from 28 to 241 MPa, and for times from 4 to 15,000 hr. As expected, it is observed that temperature, stress, and time have strong influences on substructure. The change in the dislocation density is too small to measure for conditions which

produce less than 1 percent monotonic strain. No cells form, and the major alteration of substructure is the precipitation of $M_{23}C_6$ carbides on grain boundaries, on twin boundaries, and on some dislocations. At stresses ranging from 69 to 172 MPa and at temperatures ranging from 482 to 593°C, the dislocation density increases with increasing stress and is generally higher than expected from studies made at higher temperatures. Dislocations are arranged in fine networks stabilized by carbides. At stresses above 172 MPa and temperatures to 649°C, the dislocation density is too great to measure. Cells develop which are finer in size than cells developed at similar stresses but at higher temperatures. Dislocation densities and cell sizes for cyclic specimens are comparable to data for creep-tested specimens. On the basis of the observed substructures, recommendations are made regarding further studies which would assist in the development of constitutive equations for high-temperature inelastic analysis of reactor components.

7085 (ORO—3262-54) **Deformation processes in refractory metals.** Beckerman, L.P.; Boratto, F.J.M.; Watson, P.G.; Reed-Hill, R.E. (Florida Univ., Gainesville (USA). Engineering and Industrial Experiment Station). 1977. Contract EY-76-S-05-3262. 119p. Dep. NTIS, PC A06/MF A01.

A report is presented of yield point return studies on alloys of niobium containing both oxygen and hydrogen. Here it has been observed that hydrogen has a complex effect on both the kinetics and energetics of the oxygen yield point return in niobium. Work in the area of slow strain-rate embrittlement of oxygen by niobium and its relation to dynamic strain-aging is described, along with data that has been obtained for the diffusion of oxygen and nitrogen in tantalum. They compliment similar data already published on the diffusion of oxygen and nitrogen in both niobium and vanadium. Finally, a report of the preliminary work of a study of the effects of hydrogen on both slow strain-rate embrittlement and dynamic strain aging in vanadium is presented. Because the embrittling effect of hydrogen can seriously reduce the tensile ductility it is not possible to study most aspects of dynamic strain aging using tension tests. Compression tests on the other hand do not suffer from this problem.

7086 (UCRL—52296) **Fundamental study of crack initiation and propagation. Annual progress report, March 1976—March 1977.** Norris, D.M. Jr. (ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Jun 1977. Contract W-7405-ENG-48. 83p. Dep. NTIS, PC A05/MF A01.

Ductile fracture in nuclear pressure vessel steel was characterized using a computer model of material damage. The model predicts crack initiation and growth and contains constants that are set by computer simulation of the following fracture tests: the simple tension test, the circumferentially notched round tension test, the blunt-notched compact tension test, and the Charpy V-notch test. The simulations provide the stress and strain states of these tests at fracture. The major goal of our characterization program is to determine the correlation between Charpy toughness and fracture toughness.

7087 (EURFNR—1358) **Uniaxial creep tests on tubular specimens of stainless steels X10NiCrMoTiB 1515 (1.4970) and X8CrNiMoVNb 1613 (1.4988).** Schirra, M. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). Jun 1976. Translation of KFK—2296. 51p. Dep. NTIS, PC A04/MF A01.

Work performed under United States-Euratom Fast Reactor Exchange Program.

Uniaxial creep tests at 700°C were carried out on the tubular specimens to study the effect of dynamic sodium atmosphere on the creep behaviour of X10NiCrMoTiB 1515 (DIN 1,4970) and X8CrNiMoVNb 1613 (DIN 1,4988) steels. For these experiments the facilities at CEN/SCK Research centre in Mol were used. Similar specimens were given thermo-mechanical pretreatment, conforming to the dimensions of FBR - fuel element - claddings, and tested at GfK/IMF. The results of the creep-tests at 650°C and 700°C in vacuum are given and serve as a reference basis for the tests in sodium atmosphere at Mol. The chemical analysis of the surface-layers showed that there is a change in concentration of B, C and N at the surface due to creeping. Metallographic investigations were also employed to study the fracture behaviour.

7088 (ORNL-tr—4450) **Ductility and matrix constitution of sintered W—Ni—Fe alloys.** Takeuchi, H. Translated from *J. Jpn. Inst. Met.*; **31**: No. 9, 1064-1070(1967). 15p. Dep. NTIS, PC A02/MF A01.

The influence of Ni/Fe ratio on the ductility of W-Ni-Fe Heavy Metals was studied. Sintered 95% tungsten alloys were prepared, using coreduced fine powder, with the varying Ni/Fe ratios of $^1/_9$, $^3/_7$, $^5/_5$, $^7/_3$, $^5/_2$ and $^9/_1$. In the case of alloys made by liquid-phase sintering, the optimum strength and ductility, as well as the lowest micro-hardness in matrix, were obtained at the Ni/Fe ratios from $^5/_5$ to $^7/_3$. The alloys made by solid-phase sintering were comparatively hard and less ductile. In most of the W-Ni alloys and W-Ni-Fe alloys with the Ni/Fe ratios less than $^3/_7$, two phases were observed in the bonding matrix. It is to be noted that these alloys were relatively less ductile. Electron probe microanalysis of 80% W-Ni-Fe alloys revealed that the tungsten content in the matrices changed with the Ni/Fe ratio, reaching the minimum at the Ni/Fe ratio of $^7/_3$. It was concluded that the high ductility of W-Ni-Fe alloys was obtained when there was little tungsten dissolved in the matrix and no brittle phase was contained in the system.

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 7704

7089 (BNL—23135) **Polarization of electrons emitted from ferromagnets.** Watson, R.E. (Brookhaven National Lab., Upton, N.Y. (USA)). Aug 1977. Contract EY-76-C-02-0016. 11p. (CONF-770827—6). Dep. NTIS, PC A02/MF A01.

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

A recent comment of Peter Wohlfarth in Phys. Rev. Letters concerning Eib and Alvardo's results from a spin polarized photoelectron study of the (100) surface of nickel and questions of Coulomb and crystal field shifts of surface atoms are discussed.

7090 (BNL—23236) **Effect of primary ion energy and surface chemistry on the secondary ion yields in low energy SIMS experiments.** Yu, M.L. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 18p. (CONF-771110—2). Dep. NTIS, PC A08/MF A01.

From 24. national vacuum symposium of the American Vacuum Society; Boston, Massachusetts, USA (8 Nov 1977).

The chemisorption of oxygen on W(100) and Mo(100) single crystal surfaces was studied using a static mode SIMS technique at primary ion energies ranging from 150 eV to 2 keV. The following secondary ion yields O^-, WO_2^-, and MoO_2^- were found to be sensitive to the changes in the chemisorbed oxygen layer at different stages of chemisorption. Significant enhancement in the sensitivity of the O^- yield to the chemisorption process was observed when the energy of the Ne^+ primary ion energy was below 500 eV.

7091 (CONF-770935—1) **Emission and absorption x-ray edges of Li.** Callcott, T.A.; Arakawa, E.T.; Ederer, D.L. (Oak Ridge National Lab., Tenn. (USA); National Bureau of Standards, Washington, D.C. (USA)). 1977. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From 5. international conference on vacuum ultraviolet radiation physics; Montpellier, France (5 Sep 1977).

Measurements of the K X-ray absorption and emission edges of Li are reported. They were made with the same spectrometer at the NBS storage ring and serve to establish a 0.1 eV separation between the edges with no possibility of instrument calibration error. These results are compared with recent theories of Almbladh and Mahan describing the effects of incomplete phonon relaxation about the core hole. It is concluded that these theories give a satisfactory explanation of the data.

7092 (COO—2679-14) **Direct observation of grain boundary diffusion by scanning Auger microscopy.** Janssen, A.P.; Hwang, J.C.M.; Venables, J.A.; Balluffi, R.W. (Cornell Univ., Ithaca, N.Y. (USA)). Aug 1977. Contract EY-76-S-02-2679. 8p. Dep. NTIS, PC A02/MF A01.

Scanning Auger electron microscopy has revealed the diffusion of silver at relatively low temperature along grain boundaries in gold films, and its subsequent diffusion over the surface of the films. The results point the way to quantitative studies of grain boundary and surface diffusion coefficients on a microscopic scale.

7093 (TID—27707) **Thermal conductivity, electrical resistivity and Seebeck coefficient of high purity iron and selected iron alloys from 90 K to 400 K.** Holder, T.K. (Tennessee Technological Univ., Cookeville (USA)). Jun 1977. Contract W-7405-ENG-26. 98p. Dep. NTIS, PC A05/MF A01.

Thesis.

The thermal conductivity, electrical resistivity, and Seebeck coefficient of high purity iron, two iron-chromium alloys, one iron-nickel alloy, and one iron-chromium-nickel alloy were measured over the temperature range from 90 K to 400 K. Smoothed values for the thermal conductivity and electrical resistivity were used to calculate the electronic thermal conductivity, the lattice conductivity, and the Lorenz function by means of a binary alloy separation technique. The lattice conductivity and Lorenz function exhibited little change due to the addition of chromium; however, the addition of small amounts of nickel resulted in significant property changes. The lattice conductivity at high temperatures was calculated from theory and compared to experimental results. Good agreement between theory and experimental data was obtained.

7094 (UCRL—79505) **High-temperature equation of state for simple metals.** Grover, R. (California Univ., Livermore (USA).

Lawrence Livermore Lab.). 4 Aug 1977. Contract EY-76-C-02-0016. 10p. (CONF-770537—11). Dep. NTIS, PC A02/MF A01.

From 7. symposium on thermophysical properties; Gaithersburg, Maryland, United States of America (USA) (10 May 1977).

An phenomenological equation-of-state model has been developed for simple, monatomic metals to cover the temperature and pressure ranges of 0-1 eV and 0-1 TPa. The normalization of the model to extensive experimental data on Pb is discussed as an example. The resultant equation-of-state in a mixed tabular-analytic form should be useful in technical applications where the temperature and pressure dependence of the compressibility is important. The physical basis of the model is outlined.

7095 (UCRL—80007) **Thermal expansion of metals over the entire liquid range.** Shaner, J.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Aug 1977. Contract W-7405-ENG-48. 14p. (CONF-770843—3). Dep. NTIS, PC A02/MF A01.

From International thermal expansion symposium; Winnipeg, Canada (29 Aug 1977).

This paper reviews the current state of the art for measuring liquid metal densities. Conventional high precision techniques for use below 2000K as well as new techniques for more extreme temperatures are addressed. Pertinent data, which have appeared since the last critical reviews, for elemental metals are discussed.

7096 (BNWL-tr—261) **Absorption states, rates of oxygen adsorption and desorption on rhenium, and atomization and oxidation mechanism at high temperature and low pressure.** Weber, B.; Cassuto, A. Translated from *Surf. Sci.;* **36**: 81-108(1973). 44p. Dep. NTIS, PC A03/MF A01.

Interactions of oxygen with rhenium were studied at low pressures (10^{-4} to 10^{6} torr) in an ultra high vacuum apparatus where all desorption products, including unstable and condensible species are analyzed by mass spectrometry. The chemical reactions depend on the surface coverage which is fixed by an equilibrium between the rate of adsorption and the rates of desorption steps, varying with temperature and pressure. These rates were measured independently, or directly (pressure variations after a flash, thermal desorption). When the coverage is lower than 0.7, the main reaction is oxygen atomization. For higher values, desorption of atomic oxygen is progressively replaced by desorption of rhenium trioxide, ReO_3, main product of reaction. The following mechanism, based on the kinetics of the elementary steps, experimentally isolated, gives a quantitative picture of all the phenomena, for pressures between 10^{-4} to 10^{-6} torr, and sample temperatures varying from 1500 to 2300 K: (a) dissociative adsorption of oxygen; (b) desorption of atomic oxygen; (c) desorption of trioxide, only formed by surface reaction. The different rates depend on coverage, frequency factors and binding or activation energies. Optimization of the results in stationary conditions give the values of these parameters. The agreement with the values obtained directly is excellent.

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 5796, 5878, 5879, 5881, 6109, 6325, 6326, 6620, 7080, 7085, 7096, 7185, 7250

7097 (WARD-NA—3045-46) **Sodium Technology Program: component materials compatibility. Quarterly progress report for period ending April 30, 1977.** Ray, W.E. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Aug 1977. Contract EY-76-C-02-3045-M. 46p. .

Type 304 stainless steel both in the cold worked and annealed conditions were compared with W ARD Type 304L SS standard tabs, Fe-18Cr-8Ni and Fe-12Mn reference materials in the ITF and in MTL-1. Type 316 Stainless steel creep rupture test data obtained in flowing sodium at 538°C and 593°C are compared to results obtained in-air, reported in the literature. Results obtained in-sodium for as-fabricated material show good agreement with the in-air results, in terms of rupture life, minimum creep rate and ductility. Significant differences in the same parameters are noted for the same material when tested at 593°C after pre-exposure to flowing sodium for 2000 and 5000 hours. Although the rupture life for the pre-exposed material increases by 50%, the minimum creep rate is also increased by factors of 2 and 3 for the 2000 and 5000 hour preexposures respectively. This is the result of the increased ductility (approximately 3X) obtained for the pre-exposed material. Monotonic stress-strain curves, developed from the loading strain values of creep-rupture tests for Type 316 stainless at 593°C in sodium, show that the as-fabricated material has the lowest short-term tensile strength (at 593°C), with the strength increasing for sodium ore-exposure times of 2000 and 5000 hours. Using the saturation stress from strain controlled low cycle fatigue data for Type 316 stainless steel at 593°C in-sodium cyclic stress-strain curves for sodium pre-exposed material are lower than that obtained for as-fabricated material. This decreased strength contributes to an increase in the creep-fatigue life for tension-only hold-time tests, when compared to results for as-fabricated material tested at the same total strain range of 1%. No significant difference in cyclic fatigue (zero-hold) life was obtained as a result of sodium pre-exposure.

7098 (MLM—2453) **Hydrogen in intermetallic phases: the system titanium—nickel—hydrogen.** Buchner, H.; Gutjahr, M.A.; Beccu, K.D.; Saeufferer, H. Translated from *Z. Metallkd.;* **63**: 497-500(1972). 14p. Dep. NTIS, PC A02/MF A01.

The intermetallic phases Ti_2-Ni ($E9_3$-type) and TiNi (B2-type) are able to absorb great amounts of hydrogen interstitially. The $E9_3$-structure forms four isotypic hydrogen phases, the lattice parameters of which increase with increasing hydrogen contents ($\Delta d/sub\ max/ = 5.3\%$). The stoichiometric formulas are: $Ti_2NiH_{0.5}$; Ti_2NiH; Ti_2NiH_2; $Ti_2NiH_{2.5}$. The lattice parameter of the B2-structure increases from 3.01 A to 3.10 A ($\Delta d = 3\%$), thus forming the stoichiometric TiNiH phase. The TiNiH structure possesses an eightfold superlattice having a B2 type cell. The positions of hydrogen in the two intermetallic phases Ti_2Ni and TiNi are discussed from the geometrical point of view. Neutron diffraction diagrams verify these positions for only two hydrogen phases ($Ti_2NiH_{0.5}$; Ti_2NiH). Because of extreme experimental difficulties, the exact hydrogen positions in the phases Ti_2NiH_2; $Ti_2NiH_{2.5}$; TiNiH are still unknown.

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 6583, 6587, 6662, 6685, 7224, 7697, 7777, 7779, 7780

7099 (CONF-770855—1) **In-situ radiation response of nickel—molybdenum alloys in an HVEM.** Carpenter, R.W.; Kenik, E.A. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 4p. MF A01.

From 5. international conference on high voltage electron microscopy; Kyoto, Japan (29 Aug 1977).

Experimental research has shown that perturbations of lattice periodicity caused by certain types of discrete precipitation or spinodal decomposition will suppress radiation-induced void swelling. The reported results extend this study to the Ni—Mo alloy system, in which certain alloy compositions contain short- or long-range order (SRO or LRO) and consequently modulations of the lattice periodicity.

7100 (HEDL-SA—1157) **Theoretical prediction of microstructural development during irradiation.** Powell, R.W. (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1977. Contract EY-76-C-14-2170. 30p. (CONF-770641—11). Dep. NTIS, PC A03/MF A01.

From Conference on radiation effects in breeder reactor structural materials; Scottsdale, Arizona, United States of America (USA) (19 Jun 1977).

A theoretical model has been developed which describes the formation and growth of dislocation loops, voids and network dislocations during irradiation. The dislocation loop density, average dislocation loop size, total dislocation density, void number density and average void size are calculated as functions of temperature and dose. Applications of the model include analysis of proposed swelling mechanisms and guidance in performing swelling simulation experiments. The predicted effects that changes in the stacking fault energy, surface energy, shear modulus and vacancy migration energy would have on the evolving microstructure are presented. An analysis of preconditioned specimen simulation experiments is presented, and includes a recommended indicator that the desired conditions have been achieved.

7101 (HEDL-SA—1187) **Temperature dependence of in-reactor creep of 20% cold worked 316 stainless steel.** Gilbert, E.R.; Lovell, A.J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1977. Contract EY-76-C-14-2170. 13p. (CONF-770641—10). Dep. NTIS, PC A02/MF A01.

From Conference on radiation effects in breeder reactor structural materials; Scottsdale, Arizona, United States of America (USA) (19 Jun 1977).

In-reactor creep experiments were performed on two heats of 20 percent cold worked Type 316 stainless steel at temperatures ranging from 380 to 720°C. At low temperatures, irradiation creep dominated the deformation process and higher creep rates were observed in-reactor than out-of-reactor. At higher temperatures, thermal creep was dominating and in-reactor creep strains were found to be below the levels measured in pre- and postirradiation creep tests. Irradiation creep strains were generally found to increase with increasing temperatures in both the irradiation and thermal creep domain, except for temperatures near the domain boundary where the two deformation processes are of equal importance. In this region, the creep strains increased with increasing temperature, passed through a maximum, and went through a minimum near the domain boundary and subsequently increased with increasing temperature.

CERAMICS, CERMETS, AND REFRACTORIES

REFER ALSO TO CITATION(S) 6920

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 6611

7102 (COO—2408-4) **Pressure sintering and creep deformation: a joint modeling approach. Progress report, January 1, 1977—December 31, 1977.** Notis, M.R. (Lehigh Univ., Bethlehem, Pa. (USA)). Jul 1977. Contract EY-76-S-02-2408. 12p. Dep. NTIS, PC A02/MF A01.

The joint modeling of creep deformation and pressure sintering, previously developed for the final and intermediate stages, has now been refined to include a "transition stage" that accounts for a decreasing "connectivity" for the cylindrical-open porosity and a smooth transition to spherical porosity as pinch-off occurs. As in the final and intermediate stages, this transition stage takes into account three major contributions to densification: lattice diffusional flow, grain boundary flow, and power law deformation; effects of grain growth have also been included. The model has been extensively tested and compared to experimental results on hot-pressed CoO, and is now being tested against earlier experimental data that we have obtained on $MgAl_2O_4$. Work has continued on creep studies of NiO and CoO, comparing the similarities and differences in creep behavior and relating these to dislocation structures observed in TEM. Finally, work has been completed on the grain growth of CoO as a function of porosity level, and also the effects of impurities (Cr, Li) on the creep and densification rates of CoO and NiO. These studies have provided specific information required for the intermediate stage modeling. They have also led to initial work on grain boundary segregation effects studied by STEM that we hope to continue and extend to a quantitative approach during the next year.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 6027, 7102, 7105, 7113

7103 **Structural studies of the (La, Sr)CrO_3 system.** Khattak, C.P.; Cox, D.E. (Brookhaven National Lab., Upton, NY). *Mater. Res. Bull.;* **12**: No. 5, 463-471(May 1977).

Phase relationships in the La/sub 1-x/Sr/sub x/CrO_3 (0.25 less than or equal to x less than or equal to 0) system have been investigated. Substitution of Sr into $LaCrO_3$ leads to a phase region with rhombohedral symmetry at room temperature which is oxygen-deficient under strongly reducing conditions. The orthorhombic structure of $LaCrO_3$ and the rhombohedral structure of $La_{0.75}Sr_{0.25}CrO_3$ have been refined by profile fitting of neutron powder diffraction data.

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 6599, 6609

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 5787, 5788, 6804, 7179

7104 (COO—4075-1) **Coupled diffusion phenomena in multicomponent glasses and glass forming liquids. Progress report, September 1, 1976—June 1, 1977.** Cooper, A.R. (Case Western Reserve Univ., Cleveland, Ohio (USA)). Jun 1977. Contract EY-76-S-02-4075. 33p. Dep. NTIS, PC A03/MF A01.

Oxygen self diffusion coefficients in the multicomponent K_2O—SrO—SiO_2 glass have been completed. The D values are several orders of magnitude lower than those for Sr and K. The low activation energy and low D_0 for oxygen are indicative of diffusion due to a quenched in defect. To describe such a defect may involve the possibility of a topological description for defects in amorphous lattices. A method that avoids the problem of thermal convection has been developed and samples have been prepared for self diffusion studies in molten K_2O—SrO—SiO_2. Thermal diffusion experiments were conducted but not analyzed. The coupling between convection and diffusion in the thermal case was recently summarized.

7105 (LBL—6612) **Characterization of sialon-type materials.** Spencer, P.N. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1977. Contract W-7405-ENG-48. 117p. Dep. NTIS, PC A06/MF A01.

Thesis.

Four sialon-type materials using volcanic ash as a raw material were characterized and some of their properties were determined. The M3 and M4 materials were identified as β'—Si_3N_4 sialons; their principal constituent is silicon. The M2 material was identified as a 15R-A1N polytype sialon whose principal constituent is aluminum. The M1 material is a mixture of the two types. An overview of results showing the general structural formulae and the relative order of the materials with respect to various properties as determined by the investigation is presented. It is concluded that of the materials tested, the M2 material shows the most promise as a candidate for meeting some of the current needs for high-temperature materials. It is also concluded that more research is needed in order to explain the low resistance of these materials to thermal shock since their coefficients of thermal expansion are relatively low.

7106 **Raman scattering from ion-implanted silicon carbide.** Rahn, L.A. (Michigan State Univ., East Lansing); Colwell, P.J.; Choyke, W.J. pp 514-516 of In Radiation effects in semiconductors 1976. Urli, N.B.; Corbett, J.W. (eds.). Bristol, Eng.; Adlard and Son Ltd. (1976).

From International conference on radiation effects in semiconductors; Dubrovnik, Yugoslavia (6 Sep 1976).

See CONF-760999—.

Raman scattering from H^+, D^+ and He^+ ion implanted silicon carbide is reported. In H^+ implanted samples the observed localized impurity vibrational modes are attributed to the stretch mode of silicon-hydrogen bonds. In samples implanted with higher doses, evidence for carbon-carbon bonds is observed. (GHT)

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 6605

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 6608, 6623, 6625, 6662, 6696, 6720, 7230

7107 (LA-UR—77-1564) **Transient radiation effects in low loss optical waveguides.** Golob, J.E.; Lyons, P.B.; Looney, L.D. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 12p. (CONF-770714—5). Dep. NTIS, PC A02/MF A01.

From IEEE conference on nuclear and space radiation effects; Williamsburg, Virginia, United States of America (USA) (12 Jul 1977).

Radiation-induced effects in low-loss optical waveguides were studied to determine parameters affecting the use of these materials in plasma diagnostic instrumentation operating in severe radiation environments. Radiation-induced luminescence of fibers was shown to result from the Cherenkov process within the fibers. Both spectral data and angular dependence of luminescence were used to verify the Cherenkov effect. Absolute magnitude of luminescence data were obtained. Different fiber types were shown to exhibit comparable luminescence output. Radiation-induced absorption was measured immediately following a 40-ns radiation pulse at wavelengths of 600 nm and 800 nm. Saturation effects in absorption were observed as well as changes in fiber recovery vs time as a function of radiation dose. Step- and graded-index profile fibers were shown to exhibit comparable absorption. Fibers tested included plastic-clad silica fibers, as well as graded and step index germanium-doped and boron-doped fibers. Plastic-clad silica fibers exhibited much less radiation-induced absorption than any other fiber type. The data presented allow optical fiber data links to be designed for use in severe radiation environments where data transmission is required during, or shortly after, the radiation pulse.

POLYMERS AND PLASTICS

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 7110

7108 (BNL—22640) **Production methods and applications for concrete polymer materials.** Kukacka, L.E. (Brookhaven National Lab., Upton, N.Y. (USA)). Mar 1977. Contract EY-76-C-02-0016. 12p. (CONF-771102—5). Dep. NTIS, PC A02/MF A01.

From 20. annual AICHE meeting; New York, New York, USA (13 Nov 1977).

Concrete polymer materials are being used world-wide in applications where high strength and durability are required. Methods for producing two materials, polymer impregnated concrete and polymer concrete, are discussed and their structural and durability properties summarized. Existing and potential applications for these materials such as for chemical storage tanks, pilings, pipe, curbstones, and oridge decks are reviewed.

7109 (UCRL—13734) **Fracture and fatigue of high strength filaments. Final report, September 25, 1974—August 30, 1975.** Holt, N.L.; Finnie, I. (California Univ., Berkeley (USA)). 1975. Contract W-7405-ENG-48. 107p. Dep. NTIS, PC A06/MF A01.

The history of high strength filamentary materials is traced and it is seen that their use has been widespread. It is shown that today's demands upon these materials require a better understanding of their behavior than is presently available. Current theories for both the static and fatigue strength of filamentary materials are reviewed. An analysis of static strength tests on short filaments is presented that explains seemingly anomalous test behavior which has been reported in the literature. The proposed approach is supported by experiments and computer analysis. A new machine for the fatigue testing of filaments or wires was designed and is described in detail. Results are presented for fatigue tests on tungsten wire, graphite filaments and glass filaments. Graphite filaments showed an unexpected deterioration in strength after very many cycles (10^8). An explanation of this effect is offered and supported by scanning electron microscope observations. The work concludes with some suggestions for further research.

PHYSICAL PROPERTIES

7110 (EPRI-EL—492-SR) **EPRI polymer concrete workshop, Palo Alto, California, March 14—15, 1977. Special report.** (Electric Power Research Inst., Palo Alto, Calif. (USA)). Jul 1977. 49p. Dep. NTIS, PC A03/MF A01.

The purpose of the workshop described was to exchange information on experiences and knowledge of polymer concretes, their application as an electrical insulating material, identify requirements of electric utilities, and attempt to outline a program for future development of this material. Formulations, manufacturing methods, testing procedures and designs of insulators were discussed. A new material, which has the EPRI trade name of POLYSIL, was described as a replacement for electrical porcelain. Porcelain is presently used for indoor and outdoor applications. POLYSIL was revealed as a low energy intensive material requiring less than one-fourth the processing energy of porcelain, with less than half the finished product cost. It has twice the dielectric strength and one-half the dielectric constant of electrical porcelain. Also, it exceeds the mechanical strength of presently produced electrical porcelain, is castable in simple molds, and can be produced in large cross-sections, as it has a very low exotherm during its curing stage. It was agreed that testing of POLYSIL as an insulating material should address the concerns involving impact strength, weathering degradation, attack by environmental elements (algae growth), and cracking. An external coating to improve surface properties was discussed. Utilities should help decide what types of tests they prefer and aid in field testing the polymer concrete on their systems. Participants also agreed that every effort should be made to keep the basic material development going, as it appears that knowledge has only been developed on a few formulations and their applications. The possibilities for application look much broader for the future.

OTHER MATERIALS

PREPARATION AND MANUFACTURE

REFER ALSO TO CITATION(S) 6146, 6148, 6149, 6150, 6151, 6152, 6153, 6154, 6155, 6160, 6163, 6167, 6168, 6169, 6170, 6171, 6174, 6175, 6176, 6177, 6178, 6993

7111 (SAND—76-5225C) **Processing and bonding characteristics of a urethane resin/silane primer system.** DeLollis, N.J. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 12p. (CONF-770920—2). Dep. NTIS, PC A02/MF A01.

From JOWOG-28 conference; Aldermaston, Reading, UK (20 Sep 1977).

This report describes the use of a primer to improve the adhesion of urethane resins for aluminum. The variables investigated include the effectiveness of a primer (1) used as a wipe on formulation (Table I), (2) used as received and wiped on, and (3) used as a direct additive to the resin. The results show that the direct addition of the primer to the resin gives better results than using it as an adherend wipe on coating. With EN-5 bond strengths were 13.1 MPa with the primer additive and 11.1 MPa with the primer used as a coating. The use of the primer as an additive improved bond strength in a humid environment compared to a decrease in bond strength without the primer. The bond strength values with 3121S are 10.4 MPa with the primer and 4.2 MPa without the primer. It is shown that the primer can be added to the resin at least 90 days before use without losing its effectiveness. Additional results suggest that the use of the primer may form a chemisorbed rather than physically absorbed bond. The improvement in bond strength is in terms of durability with time, since the control values (no aging) show no improvement.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 6609, 7170, 7705

7112 **Vibrational spectra, electron transitions, and structures at short distances in glasses: rare earth sulfides with gallium sulfide.** Lucazeau, G. (CNRS, Thiais, France); Barnier, S.; Loireau-Lozac'h, A.M. (CNRS, Thiais, France). *Mater. Res. Bull.;* **12**: No. 5, 437-447(May 1977). (In French).

Absorption spectra of chalcogenide glasses of general formula Ln_2S_3-$1{,}8Ga_2S_3$ (Ln = La^{+3}, Ce^{+3}, Pr^{+3}, Nd^{+3}, GD^{+3}) were investigated continuously from far infrared to ultra-violet region. Raman spectra were recorded in the $5cm^{-1}$ to 600 cm^{-1} range. Vibrational spectra of glasses have been compared to those of polycrystalline compounds $Ln_{10/3}Ga_6S_{14}$ (Ln = La^{+3}, Ce^{+3}) and $Ln_6Ga_{10/3}S_{14}$ (Ln = La^{+3} to Gd^{+3}). From the observed spectra it could be concluded that the short distance around gallium atom is strongly modified in going from crystalline to glassy state. Electronic transitions of Ce^{+3}, Pr^{+3} and Nd^{+3} ions have been also identified in the visible region and in the mid infrared absorption spectra.

7113 (COO—2126-37) **Study of vibrational and electronic excitations in ordered and disordered solids. Progress report, September 1, 1976—August 31, 1977.** Solin, S.A. (Chicago Univ., Ill. (USA)). Aug 1977. Contract EY-76-S-02-2126. 13p. Dep. NTIS, PC A02/MF A01.

The vibrational and electronic excitations of ordered, partially ordered, and disordered solids have been studied using various techniques including Raman, Brillouin, infrared, and X-ray spectroscopy together with extrinsic perturbations which include temperature and stress.

7114 (UCRL—79530) **Laser-induced fluorescence line narrowing of Eu^{3+} in lithium borate glass.** Weber, M.J.; Hegarty, J.; Blackburn, D.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1977. Contract W-7405-ENG-48. 13p. (CONF-770698—1). Dep. NTIS, PC A02/MF A01.

From Conference on boron in glass and glass ceramics; Alfred, New York, USA (5 Jun 1977).

Laser-induced fluorescence line narrowing has recently been used to investigate the local environment and interactions of paramagnetic ions in glass. Since the resulting spectra are sensitive to structural modifications, this technique was applied to study lithium borate glass. In alkali borate glasses, the relative numbers of BO_3 triangles and BO_4 tetrahedra and the existence of subliquidus immiscibility are dependent upon the mole fraction of alkali oxide. Structural changes associated with these properties are, in principle, detectable using the approach of fluorescence line narrowing. Evidence of these effects are presented.

PROPERTIES

REFER ALSO TO CITATION(S) 6160, 6168, 6170, 6605, 6638, 7706

7115 (LA-UR—77-1881) **Thermophysical properties: some experience in research, development and applications.** Wagner, P.; Acton, R.U. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 8p. (CONF-770843—2). Dep. NTIS, PC A02/MF A01.

From International thermal expansion symposium; Winnipeg, Canada (29 Aug 1977).

Accurate measurements of thermophysical properties, understanding exactly any use requirements, and understanding the behavior of the material are all potential ingredients for in-depth research and development projects. The work reported here is but a brief description of some of the many LASL and SLA projects and their chain-branching manifestations.

CORROSION, EROSION, AND DEGRADATION

7116 (UCRL—79477) **Evidence for efficient Brillouin backscatter in disks irradiated by one micron light.** Phillion, D.W.; Kruer, W.L.; Rupert, V.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 May 1977. Contract W-7405-ENG-48. 22p. (CONF-770538—4). Dep. NTIS, PC A02/MF A01.

From 7. annual symposium on the anomalous absorption of intense high frequency waves; Ann Arbor, Michigan, United States of America (USA) (18 May 1977).

Evidence for efficient stimulated Brillouin backscatter has been obtained in experiments where parylene and gold disks were irradiated at high intensities and with large scale length 4 x 10^{15} to 2.4 x 10^{17} W/cm^2, 40 to 180 μm spot diameter, 200 to 400 ps FWHM pulsewidth). These targets reflected as much as 50 percent of the incident energy back through the f/1 lens and absorbed only 10 to 20 percent of the light. At high intensities, the momentum and energy of the ion-acoustic waves, excited by the Brillouin instability and strongly damped by ion trapping, will be quickly deposited in a localized region of the underdense plasma, creating a reflection front where the density profile is nonlinearly steepened. The reflection front will move at supersonic speed into the plasma, eventually turning off the instability. Under experimental conditions where we expect this time to be long compared to the pulsewidth, no time

dependence in the back reflected light is observed, while for conditions where the reflection front is expected to have time to move through the underdense region, initially the reflection is large, but drops to a lower value after a time which roughly agrees with estimate.

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 7231, 7235

7117 Thermoluminescence mechanisms in lithium fluoride. Kathuria, S.P.; Bapat, V.N.; Sunta, C.M.; Jain, V.K. (Bhabha Atomic Research Centre, Bombay). *Natl. Bur. Stand. °U.S.°, Spec. Publ.;* No. 461, 222-226(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

Five glow peaks up to 200°C are well known in lithium fluoride after gamma irradiation. Seven new glow peaks above 200°C are reported in the present work. They are designated as I to XII in the ascending order of temperature of appearance. Activation energies are determined by initial rise method for five glow peaks, which could be well isolated by partial annealing from the lower temperature glow peaks. TL emission from the prominent glow peaks is similar and contains four bands with maxima at 370 nm, 390 nm, 415 nm, and 470 nm approximately. The spectral distribution of the total TL emission and emission from glow peaks V (195°C) and XII (400°C) are obtained also by plotting the integrated intensities of individual glow curves recorded at every 5 nm interval from 250 nm to 800 nm. The TL emission spectra obtained in this way are corrected for the instrument response. Optical absorption spectrum of lithium fluoride crystal is recorded after gamma irradiation. Distinct absorption bands are observed at 225 nm, 250 nm, 310 nm, and 380 nm. Absorption spectra are recorded also after various thermal annealing treatments. The spectral similarity of individual glow peaks and the continuous bleaching of F band (250 nm) with the annealing of individual peaks, shows that F centre takes part in recombination process at each stage of glow peak emission. The thermally released carrier at individual glow peaks is therefore of hole type.

7118 Radiation effects in semiconductors 1976. Urli, N.B.; Corbett, J.W. (eds.). Bristol, Eng.; Adlard and Son Ltd. (1976). vp. (CONF-760999—).

From International conference on radiation effects in semiconductors; Dubrovnik, Yugoslavia (6 Sep 1976).

Aspects of the interaction of energetic and ionizing radiation with defects in semiconductors are covered, as well as damage production, energy loss mechanisms, defect- and ionization-enhanced diffusion, and ion-implantation-induced defects in semiconductors. Abstracts of individual papers from the conference were prepared for the data base. (GHT)

7119 Liquid metals 1976. Evans, R.; Greenwood, D.A. (eds.). Bristol, Eng.; Inst. of Physics (1976). vp. (CONF-760754—).

From 3. international conference on liquid metals; Bristol, United Kingdom of Great Britain and Northern Ireland (UK) (12 Jul 1976).

Major topics of the conference include: liquid semiconductors, interatomic forces and thermodynamic properties of liquid metals, solutions of nonmetals in metals, individual and collective ionic motion, transition and rare earth metals in the liquid state and the metal-nonmetal transition. Abstracts of individual papers have been prepared for the data base. (GHT)

CHEMISTRY

ANALYTICAL AND SEPARATIONS CHEMISTRY

REFER ALSO TO CITATION(S) 5842

7120 (ANL—76-101) Chemical Engineering Division physical inorganic chemistry. Annual report, July 1975—June 1976. Blander, M.; Curtiss, L.A.; Hsu, C.C.; Kucera, G.H.; Marr, J.J.; Papatheodorou, G.N.; Renner, T.A.; Saboungi, M.L.; Cafasso, F.A.; Burris, L. (Argonne National Lab., Ill. (USA)). 1976. Contract W-31-109-ENG-38. 83p. Dep. NTIS, PC A05/MF A01.

The thermal conductivity of acetonitrile vapor has been measured at temperatures between 338 and 387°K and pressures between 100 and 1050 torr. The pressure dependence of the thermal conductivities indicates the presence of dimeric vapor species with an association constant given by RT ln K_2 (atm^{-1}) = 5002 - 21.15 T. Molecular orbital studies of hydrogen-bonded methyl alcohol vapor complexes indicate that, the cyclic tetramer is especially stable. Preliminary calculations on trifluoroethanol indicate that its dimer is more stable than that of methanol. Molecular dynamics calculations have been utilized to calculate the second-order coefficient of conformal ionic solution (CIS) theory. The results indicate that the repulsive part of the pair potential most commonly used for calculations on molten salts is inaccurate and that calculation of the CIS coefficient provides a sensitive test of pair potentials. Laser-Raman spectra of molten solutions of YCl_3 in CsCl, KCl and LiCl were obtained and compared with spectra of solids of known structure. The spectra at low concentrations of YCl_3 (X/sub YCl_3/ is less than 0.25) indicate an octahedrally coordinated YCl_6^{3-} species. Raman and infrared spectra of claudetite and arsenolite were measured and compared with the spectra of vitreous and liquid As_2O_3, as well as with the As_4O_6 vapor molecules.The spectrum of claudetite has some resemblance to that of vitreous and liquid As_2O_3. Raman spectra of arsenous oxide indicate that the dimeric As_2O_3 species is present. The Raman spectra of aluminum chloride vapor ($AlCl_3$ and Al_2Cl_6 vapor molecules), provided nine new bands not observed before and permitted a more complete assignment and analysis of the structure of the species to be made. The Raman spectra of In(I), In(II) and In(III) chlorides indicate the presence of InCl, In(I)In(III)Cl_4 (In_2Cl_4), $InCl_3$, and In_2Cl_6 species in the vapors. (JRD)

7121 Automatic carbon, hydrogen, nitrogen, sulfur analyzer chemistry of sulfur reactions. Dugan, G. (Hercules Inc., Wilmington, DE). *Anal. Lett.;* **10**: No. 7/8, 639-657(1977).

An automatic analyzer for the simultaneous microdetermination of carbon, hydrogen, nitrogen, and sulfur is described. The method is based on the uncatalyzed, dynamic, flash-combustion of the sample in an oxygen/helium atmosphere in a quartz tube. Separation of the combustion gases, N_2, CO_2, SO_2, and H_2O is accomplished by using gas chromatography and a thermal conductivity detector. Reactions of S_2 formation are given in detail.

ACTIVATION AND NUCLEAR REACTION PROCEDURES

REFER ALSO TO CITATION(S) 6082, 7180, 7584

7122 (ORO—5173-001) Non-destructive determination of trace-element concentrations. Annual progress report, September 1977. Gordon, G.E.; Zoller, W.H.; Walters, W.B. (Maryland Univ., College Park (USA). Dept. of Chemistry). 1977. Contract EY-76-S-05-5173. 25p. Dep. NTIS, PC A02/MF A01.

Equipment has been assembled at the National Bureau of Standards (NBS) reactor by the University of Maryland group in cooperation with the NBS staff in order to initiate studies of a new analytical technique, neutron-capture prompt γ-ray activation analysis. According to this technique one observes prompt γ-rays while the sample is under neutron bombardment, rather than observing γ rays from decay of radioactive species produced. It is expected that this technique will make possible the non-destructive determination of a number of elements in several classes of samples that cannot be measured by present analytical methods. A beam thimble has been built for insertion into the reactor. A beam stop and target holder have been designed and are under construction. The detection system has been designed and is on order. The pulse-height analyzer system has been obtained and debugged and most of the software needed has been written.

7123 (UCRL—52249) NADAC and MERGE: computer codes for processing neutron activation analysis data. Heft, R.E.; Martin, W.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 May 1977. Contract W-7405-ENG-48. 54p. Dep. NTIS, PC A04/MF A01.

Absolute disintegration rates of specific radioactive products induced by neutron irradition of a sample are determined by spectrometric analysis of gamma-ray emissions. Nuclide identification and quantification is carried out by a complex computer code GAMANAL (described elsewhere). The output of GAMANAL is processed by NADAC, a computer code that converts the data on observed distintegration rates to data on the elemental composition of the original sample. Computations by NADAC are on an absolute basis in that stored nuclear parameters are used rather than the difference between the observed disintegration rate and the rate obtained by concurrent irradiation of elemental standards. The NADAC code provides for the computation of complex cases including those involving interrupted irradiations, parent and daughter decay situations where the daughter may also be produced independently, nuclides with very short half-lives compared to counting interval, and those involving interference by competing neutron-induced reactions. The NADAC output consists of a printed report, which summarizes analytical results, and a card-image file, which can be used as input to another computer code MERGE. The purpose of MERGE is to combine the results of multiple analyses and produce a single final answer, based on all available information, for each element found.

7124 Role of high resolution Ge(Li) detector in trace element study in water activated with thermal neutrons. Chatterjee, J.M.; Peeters, E.; Castiaux, M.A. (Institut Royal des Sciences Naturelles de Belgique, Brussels). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 255-256(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

While chemical analysis is limited in its application of element detection, gamma-ray spectrometry plays a big role in the nondestructive element detection in the neutron activated samples with large volume high resolution Ge(Li) detector. The water samples from the volcanic region of the island SANTORINI (Greece) have been activated with thermal neutrons, and the gamma-rays emitted by the long-lived radioisotopes have been detected with high resolution Ge(Li) detector. The analyzed results show the high concentrations of alkaline and magnetic elements if compared with that of these elements in the normal sea water samples. The presence of some rare earth elements has been observed as well.

CHEMICAL PROCEDURES

7125 (LF—56, pp 61-65) **Sulfuric acid aerosol generation system for chronic inhalation toxicity studies.** Carpenter, R.L. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Chronic inhalation toxicity studies of sulfuric acid mists require aerosol generators capable of long-term, stable operation. Such a generator has been constructed using countercurrent injection of SO_3 into a humid airstream. Acid mist generation and dilution are controlled independently of the main exposure airflow, resulting in independent control of chamber relative humidity and aerosol concentration. The generator produces a sulfuric acid aerosol with a count median diameter of 0.29 μm (sigma/sub g/ = 1.4) and concentrations ranging from 0.07 to 2000 mg/m^3.

RADIOMETRIC AND RADIOCHEMICAL PROCEDURES

REFER ALSO TO CITATION(S) 6082, 7180, 7522, 7523

7126 (ARH-CD—811-Pt.1) **Evaluation of nondestructive assay system performance on Z-9 crib soil measurements. Phase I.** Smith, H.E. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 15 Oct 1976. Contract EY-76-C-06-2130. 30p. Dep. NTIS, PC A03/MF A01.

Evaluation of the NDA measurement results for the plutonium content of the first sixteen canisters of soil removed from the 216-Z-9 Crib Mining Facility has been completed. Results from the Soil Assay Monitor System (SAMS) were found to be biased 25 to 55 percent high in relation to the Segmented Gamma Scan Assay System (SGSAS) measurements. Within experimental error, this bias can be explained on the basis of differences in matrix density between the Los Alamos Scientific Laboratories (LASL)-prepared calibration standards and the mined soil, and to the inability of the SAMS instrument to correct for these differences. The major reason for this matrix density difference is due to the high moisture and organic content of the Z-9 surface soils when compared to the simulated standards. Correction factors have been calculated which provide for adjustment of SAMS analytical results. These factors have been used to correct the SAMS results of the original sixteen canisters, the succeeding six canisters, and remeasurements of two of the original canister group. It is recommended that derived correction factors be applied on a test basis for the remainder of the fifty canister analytical test, at which time a further evaluation will be performed. Both NDA and destructive analytical techniques are being considered at this time. Until these alternate measurements are completed, it is suggested, based on previous experience with other sample types, that the SGSAS analytical results be used in making accountability, criticality, and disposal decisions related to these fifty canisters.

7127 (LF—56, pp 105-107) **Development of radioanalytical procedures for mixed oxides of Pu, Am and U in geological specimens.** Mo, T. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A simple and routine method has been developed for separation and sequential determination by liquid scintillation counting of total Pu alpha activity, ^{241}Pu beta activity and ^{241}Am alpha activity in biological samples. The lower limit of detection of ^{241}Am by this method is 17 pCi and that of total Pu alpha activity is 10 pCi. The average chemical recovery for ^{241}Am is 104 +- 5% and that for the total Pu alpha activity is 98 +- 6%. Total U will be directly determined in an aliquot of the sample by fluorimetry.

7128 (LF—56, pp 108-110) **Improved analytical procedures for ^{210}Po in biological specimens.** Mo, T. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A simple and safe method suitable for simultaneous and multiple determinations of ^{210}Po in hamster bone and soft tissues has been developed and used routinely at this laboratory. The procedure involves wet ashing of the tissue with concentrated nitic (HNO_3) and hydrochloric (HCl) acids and 30% hydrogen peroxide (H_2O_2) at 50°C and complete dissolution in 2M HNO_3. An aliquot of this solution is gelled with a liquid scintillation cocktail and counted in a liquid scintillation spectrometer. The lower limit of detection of ^{210}Po by this method is 16 pCi for a 20-min counting time. The average chemical recovery is 97 +- 3%.

7129 (LF—56, pp 111-113) **Analysis of biological samples for americium and curium.** Miglio, J.J. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A method of analyzing biological materials by liquid scintillation counting for americium and curium which greatly reduces the contribution from ^{40}K is described. The method employs an extractant liquid scintillation cocktail using N,N,N-trioctyl-N-methyl-ammonium chloride as the extractant. Instrument as well as tissue backgrounds are reduced. The lowered backgrounds allow picocurie level samples to be analyzed by liquid scintillation counting instead of alpha pulse height analysis. The samples are reduced to a carbon-free ash and then dissolved in 8M $LiNo_3$ which is also 10^{-2}M in HNO_3. An aliquot is placed in a liquid scintillation vial along with the extractant-scintillator, shaken and counted.

7130 Silver-110 microgram sulfate analysis for the short time resolution of ambient levels of sulfur aerosol. Forrest, J.; Newman, L. (Brookhaven National Lab., Upton, NY). *Anal. Chem.;* **49**: No. 11, 1579-1584(Sep 1977).

Atmospheric particulate samples collected on glass fiber or quartz filters have been routinely analyzed for total sulfur at the milligram level with ^{110}Ag tracer. The method has been refined to permit sulfate analyses of <10 μg SO_4^{2-}. Samples are reduced with a mixture of HI, H_3PO_3, and HCl, converting SO_4^{2-} to H_2S, which is adsorbed as CdS. Metathesis of CdS with $AgNO_3$ containing tracer ^{110}Ag is followed by collection of Ag_2S on a membrane filter and gamma counting in a NaI(Tl) well counter. Recoveries of ~ 97% with a std dev of +-7% were obtained with standard sulfate solutions, and recoveries were comparable in the presence of quartz or glass-fiber particulate filters. Comparisons were made between total and soluble particulate sulfate in ambient air samples collected at urban and rural locations, utilizing the ^{110}Ag technique. The technique was also compared with a soluble sulfate turbidimetric method of analysis.

7131 Thermoluminescent determination of prehistoric heat treatment of chert artifacts. Melcher, C.L.; Zimmerman, D.W. (Washington Univ., St. Louis). *Science;* **197**: No. 4311, 1359-1362(Sep 1977).

In recent years archeologists have become interested in the extent to which prehistoric peoples heat-treated chert prior to shaping it into tools. Thermoluminescent determination of the radiation dose accumulated by an artifact since it was formed or last heated provides a simple, reliable test for such heat treatment. This test can be applied to single artifacts without the need for raw source material for comparison. Results on 25 artifacts from four sites indicate that, for many chert sources, color and luster are not useful indicators of heat treatment by prehistoric peoples.

7132 Measuring plutonium concentrations in respirable dust. Hayden, J.A. (Rockwell International, Golden, CO). *Science;* **196**: No. 4294, 1126(3 Jun 1977).

C. J. Johnson et al. (Science 193:488 (1976)) separated the respirable fraction of surface dust by ultrasonic dispersion and water sedimentation. This probably resulted in respirable fractions that included particulates too large to fall within the respirable size range, and reasons for believing this is the case are given. It is pointed out that all of the Pu outside is virtually in the respirable size range. Sampling by vacuum and collection by impaction is suggested as a way of measuring the content of Pu actually associated with respirable dust particles. A reply by C. J. Johnson, R. R. Tidball, and R. C. Severson is included. (DLC)

SPECTRAL PROCEDURES

REFER ALSO TO CITATION(S) 5818

7133 (DPSPU—77-30-7) **Analysis of cadmium in high alpha solutions.** Gray, L.W.; Overman, L.A.; Hodgens, H.F. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Plant). Jul 1977. Contract EY-76-C-09-00001. 7p. (CONF-771112—1). Dep. NTIS, PC A02/MF A01.

From 29. annual southeastern regional meeting of the American Chemical Society; Tampa, Florida, USA (9 Nov 1977).

Cadmium nitrate is occasionally used as a neutron poison for convenience in the separation of uranium, neptunium, and plutonium. As the classical methods of analysis for cadmium are very time-consuming, a method to isolate it in solution using solvent extraction of uranium, neptunium, and plutonium with TBP in an n-paraffin hydrocarbon was investigated. After removal of the radionuclides, the cadmium is determined by atomic absorption spectroscopy. Precision of the method at the 95 percent confidence level is +-2.4 percent. Alpha content of the solutions was typically reduced from 1-10 x 10^{11} dis/(min ml) ^{238}Pu to 1-15 x 10^{4} dis/(min ml). Analysis time was typically reduced from approximately 24 hours per sample to less than 1 hour.

7134 (MHSMP—77-5K) **Error analysis of mass spectrometer data. Period covered, October—December 1976.** Ashcraft, R.W. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1976. Contract EY-76-C-04-0487. 15p. Dep. NTIS, PC A02/MF A01.

A computer program utilizing weighted least squares has been used to analyze the mass spectra of gas samples. The reliability of the partial pressures has not been established because the magnitude, nature, and effect of errors in the cracking pattern and sensitivity data have not been confirmed. A series of special mass spectrometric analyses was designed to isolate these errors. A sample data case was analyzed using the nominal values of the cracking pattern and sensitivity. The nominal values were then perturbed according to the results of the special runs and the data case was analyzed again. There was not a significant change in the solutions to the system of equations by the introduction of errors to the cracking pattern and sensitivity data.

7135 (UCID—17549) **Trace uranium: its measurement by time-resolved fluorescence.** Stephens, F.B.; Haugen, G.R.; Richardson, J.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Jul 1977. Contract W-7405-ENG-48. 10p. Dep. NTIS, PC A02/MF A01.

An investigation was undertaken to extend the limits of detection of uranium in natural waters to the parts-per-trillion (10^{12}) level using a laser-induced fluorescence technique. Observations of the time-resolved fluorescence spectrum were made using two techniques—boxcar integration and a pulse counting technique. Neither technique provided greater sensitivity into the parts-per-trillion range. This has been attributed to the long fluorescence lifetime (approximately 55 μsec) of uranyl ion that results in a low fluorescence pulse density in the measured signal.

7136 **Ion-exchange separation and determination of calcium and magnesium.** Arguello, M.D.; Fritz, J.S. (Iowa State Univ., Ames). *Anal. Chem.;* **49**: No. 11, 1595-1598(Sep 1977).

Magnesium(II) and calcium(II) are separated from each other and from several other metal ions by ion-exchange chromatography on a sulfonated macroporous resin of 1.8 to 2.0 mequiv/g capacity. The eluent is 1 M ammonium chloride or 0.03 M ethylenediammonium chloride. The separated metal ions are detected automatically with a color-forming reagent and are quantitated with the aid of a calibration plot.

7137 **Surface studies of mammalian cells grown in culture by x-ray photoelectron spectroscopy.** Millard, M.M. (Dept. of Agriculture, Berkeley, CA); Bartholomew, J.C. *Anal. Chem.;* **49**: No. 9, 1290-1296(Aug 1977).

The surface elemental composition of Balb 3T3 A31 HYF mouse fibroblast cells and transformed MSV/MLV Balb 3T3 A31 HYF cells was obtained using x-ray photoelectron spectroscopy (XPS). The surface composition of the cells was sensitive to the nature of the specimen preparation; however, the oxygen to nitrogen (O/N) atom ratio varied between 3 and 1 for washed cells and fixed cells. The oxygen to nitrogen atom ratio was generally lower for transformed cells. Cell coverage on glass substrate was estimated to be 95% by comparing the silicon 2p signal from clean glass and glass substrate overlaid with cells. The change in concentration of phosphorus and sodium to a depth of approximately 40 nm into the surface of the cells was obtained combining XPS surface analysis data and oxygen plasma etching. The change in phosphorus concentration was linear with time and fairly similar for the cells before and after transformation.

7138 **Direct gas chromatographic determination of catechol in cigarette smoke.** Guerin, M.R.; Olerich, G. (Oak Ridge National Lab., TN). *Tob. Sci.;* **20**: 19-21(1976).

Catechol can be determined as its trimethylsilyl di-ether in total particulate matter (TPM) by direct gas chromatographic analysis of pyridine extracts. The procedure is typically executed with a precision of 2 to 4 percent relative standard deviation. The Kentucky Reference (1R1) Cigarette was found to deliver 0.19 milligrams of catechol per cigarette (0.44 weight percent of TPM). The much greater catechol delivery by flue-cured tobacco than burley tobacco was confirmed. The procedure promises to allow the simultaneous determination of nicotine and glycerol.

7139 **Determination of lead in human lungs by direct flameless atomic absorption analysis of small tissue samples.** Stegavik, K. (Univ. of Trondheim, Norway); Mikalsen, G.; Ophus, E.M.; Mylius, E.A. *Bull. Environ. Contam. Toxicol.;* **15**: No. 6, 734-738(1976).

The direct-atomization technique of flameless atomic absorption spectroscopy has shown to be a useful and accurate method when applied to determination of the concentration of lead in human lung tissue. The analytical results are highly reproducible and agree with those obtained by the conventional flame atomic absorption technique.

SEPARATION PROCEDURES

REFER ALSO TO CITATION(S) 7133, 7136, 7470

7140 (BNWL—2391) **Safety evaluation of cation-exchange resins.** Kalkwarf, D.R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1977. Contract EY-76-C-06-1830. 38p. Dep. NTIS, PC A03/MF A01.

Results are presented of a study to evaluate whether sufficient information is available to establish conservative limits for the safe use of cation-exchange resins in separating radionuclides and, if not, to recommend what new data should be acquired. The study was also an attempt to identify in-line analytical techniques for the evaluation of resin degradation during radionuclide processing. The report is based upon a review of the published literature and upon discussions with many people engaged in the use of these resins. It was concluded that the chief hazard in the use of cation-exchange resins for separating radionuclides is a thermal explosion if nitric acid or other strong oxidants are present in the process solution. Thermal explosions can be avoided by limiting process parameters so that the rates of heat and gas generation in the system do not exceed the rates for their transfer to the surroundings. Such parameters include temperature, oxidant concentration, the amounts of possible catalysts, the radiation dose absorbed by the resin and the diameter of the resin column. Current information is not sufficient to define safe upper limits for these parameters. They can be evaluated, however, from equations derived from the Frank-Kamenetskii theory of thermal explosions provided the heat capacities, thermal conductivities and rates of heat evolution in the relevant resin-oxidant mixtures are known. It is recommended that such measurements be made and the appropriate limits be evaluated. A list of additional safety precautions are also presented to aid in the application of these limits and to provide additional margins of safety. In-line evaluation of resin degradation to assess its safety hazard is considered impractical. Rather, it is recommended that the resin be removed from use before it has received the limiting radiation dose, evaluated as described above.

7141 (SRO—854-17) **Positive pressure columns used for solvent cleanup or chromatography.** Semonian, B.P.; Lubkowitz, J.A.; Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). Jul 1977. Contract EY-76-S-09-0854. 8p. Dep. NTIS, PC A02/MF A01.

By utilizing a mercury pressure valve, a volatile solvent, n-pentane, was conveniently used in a classical gravity-feed liquid chromatographic column. The pseudo-closed system maintained column efficiency by preventing the formation of column bubbles. The system was efficient in reducing solvent evaporation as well as preventing water condensation at the column outlet. Since free solvent vapors were eliminated, the system provided an additional safety factor when a flammable solvent, such as n-pentane, was employed. While the columns were used for solvent cleanup, a small modification would transform the system into a solute purification apparatus.

INORGANIC AND PHYSICAL CHEMISTRY

CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

REFER ALSO TO CITATION(S) 6101, 7164, 7169, 7170, 7174, 7179

7142 (BNL—23217) **Properties and reactivities of the luminescent excited states of polypyridine complexes of ruthenium(II) and osmium(II).** Sutin, N.; Creutz, C. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 49p. (CONF-770814—7). Dep. NTIS, PC A02/MF A01.

From American Chemical Society meeting; Chicago, Illinois, United States of America (USA) (29 Aug 1977).

The properties of the luminescent excited states of polypyridineruthenium(II) and -osmium(II) complexes ($^{*}ML_3^{2+}$) are discussed in terms of the properties of the ML_3^{2+}, ML_3^{3+}, and ML_3^{+} ground state species. Both $^{*}Ru(bpy)_3^{2+}$ and $^{*}Os(bpy)_3^{2+}$ exhibit spectral maxima at approximately 360 nm and 430-460 nm but the $^{*}OsL_3^{2+}$ lifetimes (approximately 9 to 85 nsec) are much shorter than those for the corresponding $^{*}RuL_3^{2+}$ species (330 to 1500 nsec).

Excited state potentials for the complexes have been estimated from their spectra and ground state potentials, as well as from photocurrent measurements at an n-type TiO_2 electrode. The reactivity of $*ML_3^{2+}$ toward outer-sphere electron-transfer parallels that of ML_3^{3+} when it undergoes reduction and that of ML_3^{+} when it undergoes oxidation. Reactions between $*ML_3^{2+}$ and ground state polypyridinemetal(II) complexes give rise to electron-transfer (+1 and +3 ions) or to energy transfer products depending on the pair of complexes used.

7143 (COO—3498-32) **Calculation of the mean force constants of the rare gases and the rectilinear law of mean force.** Lee, M.W.; Bigeleisen, J. (Rochester Univ., N.Y. (USA). Dept. of Chemistry). 1977. Contract EY-76-S-02-3498. 25p. Dep. NTIS, PC A02/MF A01.

The mean energies, (U), and the mean force constants, (nabla^{2}U), have been calculated for liquid argon and liquid krypton using the WCA perturbation theory, and for gaseous argon and krypton along the coexistence line by solution of the PY equation for the radial distribution function. Calculations have been made for the Lennard-Jones, Barker-Henderson, and Maitland-Smith potentials. There is little difference in the values of (U) and (nabla^{2}U) calculated for the three potentials. The calculated values are in good agreement with experimental data. Correlation of the calculated values of (nabla^{2}U) for the liquid and gas leads to an empirical relationship between (nabla^{2}U) and the density of the phase along the coexistence line. When the latter is combined with the law of rectilinear diameters of the density, the rectilinear law of mean force is obtained, which is in good agreement with experimental data on argon. It is shown that the scaling exponent for the mean force constant, (nabla^{2}U)/sub l/-(nabla^{2}U)/sub g/, is larger than the scaling exponent of the density below the critical temperature and becomes equal to it at the critical temperature. The rationale for the rectilinear law of mean force is provided by an expansion of the radial distribution function of the liquid in powers of the density and the use of the WCA approximation to the radial distribution function.

7144 (IS—4256) **Calculated pressure-broadened linewidths of HNO_3.** Tejwani, G.D.T.; Yeung, E.S. (Ames Lab., Iowa (USA)). Oct 1977. Contract W-7405-ENG-82. 123p. Dep. NTIS, PC A06/MF A01.

Self-broadened and foreign-gas (N_2 and O_2) broadened linewidths of HNO_3 vapor at 300°K for a wide range of quantum numbers J and K/sub a/, for all three types of transitions, have been calculated using the Anderson-Tsao-Curnutte theory of line broadening. Due to the very large dipole moment of nitric acid vapor, contributions arising from higher order multipole moments of HNO_3 to the linewidth will be insignificant and have been neglected in present computations. Thus, in the case of HNO_3-HNO_3 collisions, only dipole-dipole interaction has been included. For HNO_3-N_2 and HNO_3-O_2 collisions, dipole-quadrupole interaction was taken into account. Air-broadened linewidths of HNO_3 at 200°K have also been calculated, so that the temperature dependence can be estimated.

7145 (IS-T—784) **Chemical shift anisotropies of ^1H in H_2O(s), H_2S(s), and C_6H_6(s).** Ryan, L.M. (Ames Lab., Iowa (USA)). Oct 1977. Contract W-7405-ENG-82. 51p. Dep. NTIS, PC A04/MF A01.

Thesis.

The proton NMR in powdered samples of H_2O(s), H_2S(s), and C_6H_6(s) have been studied by multiple pulse line narrowing techniques. The resultant spectra provide nuclear magnetic shielding tensors that are (at least approximately) axially symmetric. The anisotropy is 34.2 +- 1.0 ppM for ice, 11.1 +- 1.0 ppM for the highest-temperature phase of solid hydrogen sulfide, and -5.3 +- 0.3 for benzene. Comparisons are made with previous experimental and theoretical work.

7146 **Fluorine and alkyl substituent effects on the gas-phase Lewis acidities of boranes by ion cyclotron resonance spectroscopy.** Murphy, M.K.; Beauchamp, J.L. (California Inst. of Tech., Pasadena). *Inorg. Chem.;* **16**: No. 10, 2437-2443(Oct 1977).

Formation of Lewis acid-base adducts R_3BF^- and R_2FBF^- in reactions of SF_5^- and SF_6^- with neutral boranes R_3B (R = CH_3, C_2H_5, i-C_3H_7 and F) is examined using trapped-ion cyclotron resonance techniques. Fluoride transfer reactions observed in binary mixtures of the various boranes (in the presence of traces of SF_6 acting as the source of F^-) establish the Lewis acidity order BF_3 > (i-$C_3H_7)_2FB$ > (i-$C_3H_7)_3B$ > ($C_2H_5)_2FB$ > ($C_2H_5)_3B$ > ($CH_3)_2FB$ > ($CH_3)_3B$ > SF_4 in the gas phase with F^- as reference base. Quantitative estimates of adduct bond dissociation energies D[R_3B-F^-] and heats of formation of adducts R_3BF^- are derived. Variations in Lewis acidity resulting from alkyl and fluoro substitution on boron are discussed in terms of properties characteristic of substituents and the anion reference base.

7147 **Ionization equilibria of silicic acid and polysilicate formation in aqueous sodium chloride solutions to 300°C.** Busey, R.H.; Mesmer, R.E. (Oak Ridge National Lab., TN). *Inorg. Chem.;* **16**: No. 10, 2444-2450(Oct 1977).

The ionization behavior of silicic acid and polysilicate formation in basic solutions have been studied by precise potentiometry using titration techniques in a hydrogen-electrode concentration cell. Polysilicate formation was studied in 1 m NaCl solutions at temperatures from 60 to 290°C and at Si(IV) concentrations 0.005 to 0.05 m. At the lowest silica concentration only mononuclear species occur over wide temperature and pH ranges. At hydroxyl numbers from about 0.7 to 1.0 (average charge per silicon) small polysilicates which equilibrate rapidly occur at higher Si(IV) concentrations. Polysilicate formation decreases with increasing temperature. The equilibrium quotient for the most significant reaction, $Si(OH)_4(aq) + OH^- \rightleftharpoons SiO(OH)_3^- + H_2O$, has been precisely determined from 0.1 to 5.0 m NaCl and to about 300°C. Values of the logarithm of the equilibrium quotient for the reaction are 3.96 and 2.20 at 50 and 300°C in 1 m NaCl and 4.32 and 2.26 at the same two temperatures in 5 m NaCl. An analytical expression from which the thermodynamic quantities for the reaction can be computed is presented. The small effect of salt concentration is interpreted as evidence for little or no sodium ion complexing.

7148 **Sputtered gold and silver atoms isolated in D_2, Ne, and N_2 matrices.** Gruen, D.M.; Bates, J.K. (Argonne National Lab., IL). *Inorg. Chem.;* **16**: No. 10, 2450-2453(Oct 1977).

The spectra of sputtered gold and silver atoms isolated in D_2, Ne, and N_2 matrices are reported. An inverse relationship between Z/sub eff/ of the metal atom and α, the polarizability of the matrix, has been extended to include si'ver atoms in D_2 and N_2 matrices. The correlation breaks down for Ne matrices apparently because the size of a substitutional site and polarizability of neon are such as to cause multiple-site occupation. Evidence for multiple-site occupation of silver in neon is presented. Intense and resolved spectra of silver dimers are also reported, and a correlation with the gas-phase spectra is made.

7149 **Synthesis and properties of sulfur dioxide adducts of organophosphinecopper(I) iodides. Structures of the dinuclear compounds tetrakis(methyldiphenylphosphine)di-μ-iodo-dicopper(I)-sulfur dioxide and tris(triphenylphosphine)di-μ-iodo-dicopper(I).** Eller, P.G.; Kubas, G.J.; Ryan, R.R. (Los Alamos Scientific Lab., NM). *Inorg. Chem.;* **16**: No. 10, 2454-2469(Oct 1977).

Compounds of the general formula Cu/sub m/I/sub m/(PR_3)/sub n/ . xSO_2, where PR_3 = PPh_3, PPh_2Me, $PBzl_3$, and PCy_3 (Bzl = benzyl; Cy = cyclohexyl), are formed by direct reaction of SO_2 with organophosphine copper (I) iodide complexes. The nature of the reaction solutions and isolated products has been elucidated by spectroscopic, tensimetric, and x-ray diffraction methods. Sulfur dioxide complexation occurs only at the coordinated halogen, even when three-coordinate copper (I) apparently is present in the complex. The strength of interaction is a strong function of both the specific phosphine and stoichiometry, and the bright yellow to orange crystalline complexes have SO_2 dissociation pressures of 2 to 70 Torr at ambient temperature. The crystal structure analysis of $Cu_2I_2(PPh_2Me)_4$. SO_2 reveals a dimeric, di-μ-iodo-bridged structure involving pseudotetrahedral copper atoms and an SO_2 group bound weakly as a Lewis acid to one of the bridging iodides (I—S = 3.407 (5) A and I—S—O = 98.1 (6), 114.5 (8)°). Additionally, we report the structure of the compound $Cu_2I_2(PPh_3)_3$ and its interaction with sulfur dioxide. X-ray structure determination reveals a dinuclear unit similar to that found in $Cu_2Cl_2(PPh_3)_3$ with μ-iodide bridges and both three-coordinate copper and four-coordinate copper. Pertinent crystallographic data are as follows: $Cu_2I_2(PPh_3)_3$, space group $P2_1$, a = 11.763 (4) A, b = 20.682 (4) A, c = 10.527 (3) A, β = 105.66 (2)°, Z = 2, R = 0.047 for 4139 diffractometric reflections [with I ≧ 3σ(I) and 2θ ≦ 60°]; $Cu_2I_2(PPh_2Me)_4SO_2$, space group P anti l, a = 20.02 (2) A, b = 12.062 (6) A, c = 14.898 (7) A, α = 116.30 (3)°, β = 68.44 (3)°, γ = 124.89 (2)°, Z = 2, R = 0.052 for 7112 diffractometric reflections [with I ≧ 3σ(I) and 2σ ≦ 50°].

7150 **Novel sulfur dioxide coordination in nitrosyl(sulfur dioxide)bis(triphenylphosphine)rhodium and an oxygen-18 study of its reaction with molecular oxygen.** Moody, D.C.; Ryan, R.R. (Los Alamos Scientific Lab., NM). *Inorg. Chem.;* **16**: No. 10, 2473-2478(Oct 1977).

Crystals of $Rh(NO)(SO_2)(PPh_3)_2$ have been obtained from SO_2-saturated solutions of $Rh(NO)(PPh_3)_3$, and the structure has been determined at 25°C. The compound crystallizes in the orthorhombic space group Pbca with a = 10.338 (2) A, b = 18.500 (4) A, c = 33.933 (7) A, d/sub c/ = 1.48 g cm^{-3}, d/sub m/ = 1.47 g cm^{-3}, and Z = 8 (Cu Kα_1 radiation, λ 1.540 51 A). The structure refined to an unweighted R value of 0.038 for 2615 reflections with I > 2σ(I). The SO_2 binds to the metal both through the sulfur atom and through one oxygen atom with a Rh-S distance of 2.326 (2) A and a Rh—O(2) distance of 2.342 (5) A. The S—O(2) distance of 1.493 (5) A is considerably longer than the S—O(1) distance of 1.430 (5) A, while the O(1)—S—O(2) angle is 115.1 (4)°. The RhNO unit in this

structure is clearly bent with a Rh—NO angle of 140.4 (6)°. The factors influencing the bending of the nitrosyl are discussed in terms of the metal coordination geometry and number of d electrons. The mechanism of the reaction of this S,O-bonded SO_2 with molecular oxygen to form coordinated sulfate has been studied utilizing oxygen-18 substitution and infrared analysis. This study has revealed a distribution of the labeled oxygen in the resulting $Rh(NO)(SO_4)(PPh_3)_2$ different from that observed for S-bonded SO_2 reactions with molecular oxygen.

7151 Polybismuth anions. Synthesis and crystal structure of a salt of the tetrabismuthide(2-) ion, Bi_4^{2-}. A basis for the interpretation of the structure of some complex intermetallic phases. Cisar, A.; Corbett, J.D. (Ames Lab., IA). *Inorg. Chem.;* **16**: No. 10, 2482-2487(Oct 1977).

The intermetallic compounds K_5Bi_4 and K_3Bi_2 have been found to react with solutions of 4,7,13,16,21,24-hexaoxa-1,10-diazabicyclo[8.8.8]hexacosane (2,2,2-crypt) in ethylenediamine to form deep green-red dichroic solutions. These spontaneously deposit black crystals of the compound 2,2,2-crypt—potassium tetrabismuthide(2-), $C_{18}H_{36}N_2O_6K^+)_2Bi_4^{2-}$, with more reduced compounds remaining in solution. This compound crystallizes in the triclinic space group P anti l with lattice constants a = 11.604 (4) A, b = 11.796 (4) A, c = 11.096 (3) A, α = 98.12 (3)°, β = 98.02 (3)°, and γ = 61.37 (3)° with one formula unit per cell. Three-dimensional x-ray data were collected from two crystals on an automated diffractometer using monochromatic Mo Kα radiation, and the structure was deduced by conventional heavy atom techniques. Positional and anisotropic thermal parameters of the 29 independent nonhydrogen atoms refined by full matrix least squares using 2704 unique observed ($I > 3\sigma_I$) reflections to R = 0.121, R/sub w/ = 0.147. Four of the carbon atoms in the ligand exhibit extremely anisotropic thermal parameters, which effect was resolved and refined in terms of pairs of disordered atoms at 0.50 occupancy. The Bi_4^{2-} anion effectively exhibits D_4/sub h/ symmetry with observed bond lengths of 2.936 (2) and 2.941 (2) A and bond angles of 89.85 (6) and 90.15 (6)°. The bonding is considered to be the same as in the isoelectronic Te_4^{2+}. The Bi_4^{2-} ion provides a useful starting point for the interpretation of the square metal groups found in the isostructural $Ca_{11}Bi_{10}$, $Ca_{11}Sb_{10}$, and $Ho_{11}Ge_{10}$.

7152 X-ray photoelectron spectroscopic study of iron(II) spin equilibrium complexes and their cobalt(II) and nickel(II) analogues. Lazarus, M.S.; Hoselton, M.A.; Chou, T.S. (Brookhaven National Lab., Upton, NY). *Inorg. Chem.;* **16**: No. 10, 2549-2553(Oct 1977).

The 2p x-ray photoelectron spectra (XPS) of a series of iron(II) spin equilibrium complexes exhibit broad satellite structure. It is generally assumed that transition metal satellites are the result of either multiplet splitting or shake-up. From a comparison of the XPS spectra of the iron(II) complexes with the analogous cobalt(II) and nickel(II) systems and from temperature-dependence studies on the iron(II) spin equilibrium complexes we have been able to conclude that the satellites in these cases are associated with a decomposition product which appears upon irradiation in the spectrometer. Decomposition of the iron(II) complexes follows a pattern based on the spin state of the metal center. For the two complexes which are mostly high spin at 40°C, decomposition appears to be complete before statistically significant spectra can be collected. The low-spin complex and the spin equilibrium complex which is mostly low spin at 40°C did not exhibit any signs of the broad satellite associated with decomposition. At elevated temperatures (150°C) where the latter complex approaches a 50/50 mixture of high spin and low spin decomposition is again complete before a minimal spectrum can be completed. Preliminary evidence for a correlation between the crystal field stabilization energy or the spin multiplicity of the metal center and the decomposition process is discussed.

7153 Kinetics of the formation and bond cleavage reactions of an alkyl-bridged dicobalt organocobaloxime. Espenson, J.H.; Chao, T.H. (Ames Lab., IA). *Inorg. Chem.;* **16**: No. 10, 2553-2557(Oct 1977).

The reaction of the tributylphosphine—cobaloxime(I) complex with 1,4-dibromobutane forms, in succession, 4-bromobutylcobaloxime and a 1,4-butenyldicobaloxime, $BCo(dmgH)_2(CH_2)_4Co(dmgH)_2B$. The latter complex with B = H_2O undergoes successive dealkylation reactions with Hg/sub aq/$^{2+}$, forming first $(H_2O)Co(dmgH)_2(CH_2)_4Hg^+$ and then $Hg(CH_2)_4Hg^{2+}$. The organocobaloximes also undergo protonation equilibria at oxime oxygen positions. Quantitative studies of the rates and equilibria of these reactions are reported, along with data for the comparison complex n-butylcobaloxime.

7154 Kinetics and mechanism of the demetalation of iron(III) porphyrins catalyzed by iron(II). Espenson, J.H.; Christensen, R.J. (Ames Lab., IA). *Inorg. Chem.;* **16**: No. 10, 2561-2564(Oct 1977).

The demetalation of iron(III) porphyrins by HCl in acetic acid is catalyzed by iron(II). Rate determinations for three compounds support a mechanism consisting of two steps: reduction to the iron(II) porphyrin and decomposition of the latter by HCl. The first step follows the rate law k_1[ClFe/sup III/P][Fe(II)][HHCl] and the second k_2[Fe/sup II/P][HCl]/sup n/, with n = 2 or 3 depending upon the porphyrin. Depending on concentration variables, either of the steps may be rate determining. The role of the iron(II) porphyrin as an intermediate is supported by measurements of its competitive reactions with HCl and with iron(III).

7155 Thermal decomposition of nitrosyl cyanide. Illige, J.D.; Jolly, W.L. (Lawrence Berkeley Lab., CA). *Inorg. Chem.;* **16**: No. 10, 2637-2639(Oct 1977).

The stoichiometry of the thermal decomposition of nitrosyl cyanide was investigated. Nitrogen-15 was used as a tracer to obtain information about the mechanism of the reaction. (LK)

7156 ESCA spectra of trimethylenmethaneiron tricarbonyl and butadieneiron tricarbonyl. Koepke, J.W.; Jolly, W.L.; Bancroft, G.M.; Malmquist, P.A.; Siegbahn, K. (Univ. of California, Berkeley). *Inorg. Chem.;* **16**: No. 10, 2659-2661(Oct 1977).

ESCA was used to study the bonding in trimethylenemethaneiron tricarbonyl and butadieneiron tricarbonyl. Back-bonding is given as the explanation for the stronger bonds between the three CH_2 groups of trimethylenemethaneiron tricarbonyl than between the iron atom and the central carbon. The same is true of the butadiene group of butadieneiron tricarbonyl. (LK)

7157 Temperature dependence of the extinction coefficient of mercuric iodide vapor. Heat of sublimation and vapor pressure of solid HgI_2. Abraham, B.M.; Jeannotte, A. (Argonne National Lab., IL). *Inorg. Chem.;* **16**: No. 9, 2270-2272(Sep 1977).

The temperature dependence of the extinction coefficient of HgI_2 vapor has been determined at a single wavelength of 342 nm where the data can be represented by the equation $\epsilon(\lambda$ 342 nm, T) = (0.803 +- 0.008)T/K - (273.1 +- 4.1). Measurements of the absorbance of the vapor in equilibrium with the solid as a function of temperature yielded the following vapor pressure equation, where the pressure is in millimeters of Hg (reduced to 273.15 K and standard gravity) and the temperature is in Kelvins: ln P = -(9959 +- 71)K/T + (23.28 +- 0.16), 417 $\leqq$ T $\leqq$ 509. The heat of sublimation calculated from this equation is 82.80 kJ mol^{-1}. The linear dependence of ln P vs. 1/T also establishes Beer's law for the vapor.

7158 Kinetics and mechanism of the formation of alkylcobalt(chelate) complexes from organic peroxides and cobalt(II). Espenson, J.H.; Martin, A.H. (Iowa State Univ., Ames). *J. Am. Chem. Soc.;* **99**: No. 18, 5953-5957(31 Aug 1977).

The reactions of some cobalt(II) macrocyclic complexes with some tert-alkyl hydroperoxides occur with a 2 : 1 (cobalt : peroxide) stoichiometry and lead to the formation of alkyl—cobalt products. Kinetic studies carried out at μ = 0.10 $M(HClO_4$-$LiClO_4)$ in 1 : 1 (v/v) tert-butyl alcohol—water media showed the reaction to be first order in both cobalt(II) complex and hydroperoxide. The bimolecular rate constants varied over the range 6.4-409 $M^{-1}s^{-1}$ with the reactivity order being $Co(dmgH)_2 > Co(dpnH)^+ >$ B/sub 12r/ $\approx Co(tim)^{2+} > Co(Me_6[14]4,11\text{-dieneN}_4) > Co(Me_6[14]aneN_4)$. The reactions of $Co(tim)^{2+}$ with a variety of peroxides showed little effect on varying the alkyl group of the hydroperoxide, but were substantially inhibited by substituting groups OR for the hydroxyl group of the hydroperoxides. Comparisons of these reactions with the analogous chromium(II) reactions will be made.

7159 Gas phase basicities and relative proton affinities of compounds between water and ammonia from pulsed ion cyclotron resonance thermal equilibria measurements. Wolf, J.F.; Staley, R.H.; Koppel, I.; Taagepera, M.; McIver, R.T. Jr.; Beauchamp, J.L.; Taft, R.W. (Univ. of California, Irvine). *J. Am. Chem. Soc.;* **99**: No. 16, 5417-5429(3 Aug 1977).

The pulsed ion cyclotron resonance method for precise determinations of proton transfer equilibrium constants has been applied to 46 carbon, nitrogen, oxygen, phosphorus, sulfur, arsenic, and selenium bases, with duplicating overlapping sequences, to obtain the relative proton affinities of water and ammonia. Where comparison is possible, the results are in generally good accord with those obtained by high-pressure mass spectroscopy. The results provide important new insights into the intrinsic effects of molecular structure on base strengths. Applications of these results to derive other gaseous ion thermochemical data are illustrated. In particular, methyl substituent effects on proton affinities have been extensively evaluated and interpretations are made of the comparisons with corresponding effects of homolytic bond dissociation energies of the conjugate acids of n-bases and with the hydride affinities of substituted methyl cations. Comparisons of the effects of n-alkyl substituents on the proton affinities of water and alcohols with carboxylic acids and their esters indicate that protonation is thermodynamically favored in the gas phase at the carbonyl oxygen of the latter. Large effects of polar electronegative substituents have been observed for various oxygen and nitrogen bases. An evaluation of entropy effects in gas phase proton transfer equilibria shows such effects to be generally small for simple bases and approximately equal to entropy

effects expected for changes in molecular rotational symmetry numbers. Finally, the present result provides the basis for evaluations of absolute proton affinities and of relative ion solvation energies.

7160 (ORNL-tr—4435) **Activity coefficient of nitrous acid and the equilibrium constants of dinitric trioxide formation.** Schmid, H.; Kremayr, P. Translated by T.W. Appich Jr. from *Monatsh. Chem.;* **98**: 417-422(1966). 6p. Dep. NTIS, PC A02/MF A01.

The activity coefficient of nitrous acid was determined in aqueous $HClO_4$. Up to a concentration of 6 mol/liter of $HClO_4$, the activity factor was noted to be linearly dependent on the ion concentration. With allowance for the activity factors of nitrous acid, the thermodynamic equilibrium constant of the reaction of HNO_2 reversible $N_2O_3 + H_2O$ was recalculated from the test results of Turney.

7161 (ORNL-tr—4438) **Question of the isometry of dinitrogen tetroxide: the kinetics of the conversion of nitrogen dioxide with hydrazoic acid in the gas phase.** Seel, F.; Birnkraut, W.; Lange, E. Translated by T.W. Appich Jr. from *Chem. Ber.;* **94**: 1436-1442(1961). 8p. Dep. NTIS, PC A02/MF A01.

The kinetics of converting nitrogen dioxide with hydrazoic acid gas in the temperature range from 20 to 50° [centigrade] was studied by spectrophotometry. The reaction is a second-order reaction with regard to NO_2 and a first-order reaction with regard to N_3H. The negative temperature coefficient of its velocity indicates an established exothermal equilibrium. For the conversion of "normal N_2O_4" with hydrazoic acid, an activation energy of 3.2 kcal/mol can be calculated with the aid of the dissociation constant of dinitroen tetroxide. The stoichiometry of the conversion and the resulting anomalous Arrhenius factor, however, indicate that nitrogen dioxide does not react with hydrazoic acid via the symmetric dinitrogen tetroxide present in the NO_2/N_2O_4 equilibrium, but rather via the isomeric molecule form $ONONO_2$ (nitrosylic nitrate). Thermodynamic data relative to the equilibrium between the two isomers can be estimated.

ISOTOPE EFFECTS

7162 **Calculation of isotopic partition functions ratios by a perturbation theory technique. 2. Dissection of the isotope effect.** Skaron, S.A.; Wolfsberg, M. (Univ. of California, Irvine). *J. Am. Chem. Soc.;* **99**: No. 16, 5253-5261(3 Aug 1977).

Statistical mechanical perturbation theory is applied to the evaluation of molecular partition functions and (reduced) isotopic partition function ratios $[(s_2/s_1)f]$ are calculated. The unperturbed vibrational problem corresponds to noninteracting stretches, bends, torsions, etc. It is demonstrated that an analysis of the unperturbed problem yields important insights into the magnitude of $(s_2/s_1)f$ values and into the isotope effects on chemical equilibria which can be calculated from these quantities. In such an analysis, one does not need to consider normal mode vibrational frequencies but one considers instead the frequencies corresponding to noninteracting individual coordinates. The contributions of the individual coordinates to $(s_2/s_1)f$ values and to isotope effects on equilibrium constants are presented.

ISOTOPE EXCHANGE AND ISOTOPE SEPARATION

REFER ALSO TO CITATION(S) 7174

7163 (COO—3498-31) **Liquid-vapor isotope fractionation factors in argon—krypton binary mixtures.** Lee, M.W.; Neufeld, P.; Bigeleisen, J. (Rochester Univ., N.Y. (USA). Dept. of Chemistry). 1977. Contract EY-76-S-02-3498. 34p. Dep. NTIS, PC A03/MF A01.

An equilibrium isotope effect has been studied as a continous function of the potential field acting on the atom undergoing isotopic exchange. This has been accomplished through a study of the liquid vapor isotope fractionation factors for both $^{36}Ar/^{40}Ar$ and $^{80}Kr/^{84}Kr$ in a series of binary mixtures which span the range between the pure components at 117.5°K. The $^{36}Ar/^{40}Ar$ fractionation factor increases (linearly) from $(1n\alpha)$ $2.49x10^{-3}$ in pure liquid argon to 2.91 x 10^{-3} in an infinitely dilute solution in liquid krypton. Conversely, the $^{80}Kr/^{84}Kr$ fractionation factor decreases (linearly) from $ln\alpha$) 0.98 x 10^{-3} in pure liquid krypton to $0.64x10^{-3}$ in an infinitely dilute solution in pure liquid argon. The mean force constants on both argon and krypton atoms in the mixtures are derived from the respective isotope fractionation factors. It is shown that the mean force constant on argon atoms in infinitely dilute solution in krypton is equal to the mean force constant on krypton atoms in infinitely dilute solution in argon. The mean force constants for argon and krypton as a function of composition have been calculated by a modified corresponding states theory which uses the pure liquids as input parameters.

ORGANIC CHEMISTRY

REFER ALSO TO CITATION(S) 5810

CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

REFER ALSO TO CITATION(S) 6458, 7142, 7145, 7146, 7149, 7153, 7156, 7158

7164 (IS-T—774) **Kinetics and mechanism of dealkylation of the alkyl-bridged dimetallic cobaloximes and the acid decomposition of hydridocobaloxime.** Chao, T.H. (Ames Lab., Iowa (USA)). Oct 1977. Contract W-7405-ENG-82. 103p. Dep. NTIS, PC A06/MF A01.

Thesis.

The reaction of the excess tributylphosphine-cobaloxime complex with 1,4-dibromobutane forms, in succession, 4-bromobutyl cobaloxime and a 1,4-butenyl dicobaloxime. This dimetallic alkyl-bridged organocobaloxime undergoes successive dealkylation reaction with Hg^{2+}/sub aq/. The organocobaloxime also undergo protonation equilibria at oxime oxygen position. Quantitative studies of the rates and equilibria of these reactions are reported, along with data for the comparison complex n-butylcobaloxime. The forward rate of the reaction $2HCo(Hdmg)_2P(n\text{-}C_4H_9)_3 = H_2 + 2Co(Hdmg)_2P(n\text{-}C_4H_9)_3$ has been determined in methanol-water solutions as a function of perchloric acid concentration, 0.003-0.10 M. The reaction proceeds by two parallel pathways, with respective first-order and second-order dependences upon the concentration of hydridocobaloxime. Once allowance is made for an H^+-dependent equilibrium with $K = 130\ M^{-1}$, which we interpret to be the protonation of oxime oxygens, the first-order term proceeds at a rate directly proporational to (H^+), and the second-order term is independent of H^+ concentration. Deuterium labeling experiments were also carried out. The reaction appears to proceed by parallel heterolytic and homolytic cleavage of the hydrogen cobalt bond.

7165 (IS-T—782) **Crystal and molecular structure of organophosphorus insecticides.** Baughman, R.G. (Ames Lab., Iowa (USA)). Oct 1977. Contract W-7405-eng-82. 133p. Dep. NTIS, PC A07/MF A01.

Thesis.

The crystal and molecular structures of the following organophosphorus (OP) insecticides have been determined by three-dimensional X-ray analysis: ronnel (0,0-dimethyl 0-2,4,5 trichlorophenyl phosphorothioate), ronnel oxon (0,0-dimethyl 0-2,4,5 trichlorophenyl phosphate), bomophos (0-(4-bromo-2,5-dichlorophenyl) 0,0-dimethyl phosphorothioate), Ruelene (0-(4-tert-Butyl-2-chlorophenyl)-0-methyl-N-methyl phosphoroamidate), fospirate (0,0-dimethyl 0-3,5,6-trichloro-2-pyridyl phosphate) and chlorpyrifos (0,0-diethyl 0-3,5,6-trichloro-2-pyridyl phosphorothioate). Phosphorus to meta hydrogen distances for the respective compounds are: 5.51, 5.49, 5.42, (5.68, 5.13), 5.79 and 5.78 A. All of these distances fall well within the range of literature values cited for the intramolecular active site-separation distance for insect acetylcholinesterase (AChE), yet are well outside that for mammalian AChE. In addition the crystal structure of ronnel displays a hydrogen-sulfur intermolecular interaction in the b direction and a phosphorus which is readily accessible for phosphorylation of AChE. The structure of ronnel oxon is quite similar to that of ronnel. CNDO 11 molecular orbital calculations are presented to show the charge distribution in the compound. A likely intramolecular hydrogen bond in bromophos restricts rotation about the phenolic C-O bond. The configuration of Ruelene is substantiated by CNDO 11 molecular orbital calculations and van der Waals arguments and features a possible weak intramolecular hydrogen bond which somewhat restricts rotation about the phenolic C-O bond. Charge density information is also presented. The heterocyclic portion of fospirate and chlorpyrifos allow torsional angles about the pyridoxic C-O bond to be substantially different from the pnenoxy OP's. CNDO 11 molecular orbital calculations are presented.

7166 (SAND—77-1267C) **MOCA replacement.** Quant, A.J. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 4p. (CONF-770920—1). Dep. NTIS, PC A02/MF A01.

From JOWOG-28 conference; Aldermaston, Reading, UK (20 Sep 1977).

A di-thioaniline substituted ethane was found to yield satisfactory pot-life and less adverse physiological bahavior. When used as a curing agent for Adiprene L-100 urethane prepolymer, MOCA-like properties were obtained over a wide temperature range. (DLC)

7167 (SRO—854-16) **Effects on gas chromatographic peaks of electric fields applied across cholesteric liquid crystal stationary phases.** Conaway, J.E.; Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). Jun 1977. Contract EY-76-S-09-0854. 26p. Dep. NTIS, PC A03/MF A01.

Earlier studies have shown that a static electric field across a capillary column increased the apparent capacity ratio (measured from the peak maximum) of a liquid crystal stationary phase and produced a more nearly Gaussian-shaped peak plus a small step on

the front of the peak. The present study has qualitatively confirmed those effects using cholesteryl laurate, cholesteryl 10-undecenoate, and cholesteryl benzoate and suggests that they may be found for all cholesteric liquid phases. In addition, the peak-fronting phenomenon was found to be a function of both the carrier gas and the applied column potential. Fragmentation of the solute and/or the stationary phase by carrier gas molecules in metastable excited states is proposed to explain the fronting phenomenon. Hysteresis effects have also been observed, indicating that the liquid crystals may take hours to return to their original orientations after imposition or removal of an electric field.

7168 Hydroxyl radical reactivity with diethylhydroxylamine. Gorse, R.A. Jr.; Lii, R.R.; Saunders, B.B. (Argonne National Lab., IL). *Science;* **197**: No. 4311. 1365-1367(Sep 1977).

Diethylhydroxylamine (DEHA) reacts with gas-phase hydroxyl radicals on every third collision, whereas the corresponding reaction in aqueous solution is considerably slower. The high gas-phase reactivity explains the predicted inhibitory effect of DEHA in atmospheric smog processes. Results from the studies in the aqueous phase are helpful in predicting the mechanism of the reaction of DEHA with hydroxyl radicals.

7169 Proton and carbon lanthanide-induced shifts in aqueous alanine. Evidence for structural changes along the lanthanide series. Sherry, A.D.; Pascual, E. (Univ. of Texas, Dallas). *J. Am. Chem. Soc.;* **99**: No. 18, 5871-5876(31 Aug 1977).

Proton and carbon lanthanide-induced shifts are reported for aqueous alanine at pH 3. A comparison of the measured shifts with theoretical values provides evidence for changes in the coordination behavior of alanine between Tb^{3+} and DY^{3+}. An apparent stability constant ($K_1 = 0.7 +- 0.1\ M^{-1}$) was measured for eight lanthanide ions and found insensitive to changes in alanine coordination geometry. The measured shifts are separated into their contact and pseudocontact components and the resulting corrected pseudocontact shift ratios are compared with values calculated using the axial symmetry model to deduce the dynamic alanine structures. A monodentate coordination geometry is proposed for the ions $Pr^{3+} \rightarrow Tb^{3+}$ and a bidentate carboxyl coordination structure is evident for the ions $Dy^{3+} \rightarrow Yb^{3+}$. The carbon shifts are dominated by polarization of unpaired spin away from the ligating oxygen(s) and mediated by a direct delocalization of spin resulting in a greater unpaired spin density at C/sub α/ than C_β. Although the proton shifts are primarily pseudocontact in origin, the separation method reveals a change in sign and increased magnitude of spin density at the protons on changing from monodentate to bidentate coordination. This behavior may parallel known hydration sphere alterations along the lanthanide series.

7170 X-ray photoemission spectra of the 2s valence orbitals in cyclic alkanes in relation to valence bands of amorphous Group 4 and 5 elements. Mills, B.E.; Shirley, D.A. (Univ. of California, Berkeley). *J. Am. Chem. Soc.;* **99**: No. 18, 5885-5888(31 Aug 1977).

The crystalline elements Ge, Si, As, Sb, and Bi display a characteristic two-peak structure in the x-ray photoelectron spectra of their s-like valence bands. In the corresponding amorphous materials the gap between these two bands is filled in. It has been suggested that this is a consequence of topological disorder, i.e., of the existence of odd-membered rings (especially five-membered rings) in the amorphous cases, whereas the crystalline solids contain only six-membered rings. To test this hypothesis we have studied tetrahedrally bonded systems of different ring size in the gas-phase cyclic alkanes. The XPS spectrum of cyclohexane shows a striking resemblance to that of diamond. The other gas-phase spectra can be combined according to different ring-structure models. When this is done, we find that five- and six-membered rings alone are not sufficient to explain the "filling-in effect", but that five-, six-, and seven-membered rings are. The topological disorder model of bonding in amorphous semiconductors therefore appears valid. More generally, this work establishes further links between molecular orbital theory and bonding in covalent solids.

7171 Carbenium ion stabilities in the gas phase and solution. An ion cyclotron resonance study of bromide transfer reactions involving alkali ions, alkyl carbenium ions, acyl cations, and cyclic halonium ions. Staley, R.H.; Wieting, R.D.; Beauchamp, J.L. (California Inst. of Tech., Pasadena). *J. Am. Chem. Soc.;* **99**: No. 18, 5964-5972(31 Aug 1977).

Ion cyclotron resonance techniques are used to measure relative heterolytic bond dissociation energies $D(R^+ - Br^-)$ in the gas phase for a series of alkali cations, alkyl carbenium ions, acyl cations, and cyclic halonium ions. $D(R^+ - Br^-)$ for adamantyl cation is found to be less than for tert-butyl cation. A proton affinity for norbornene of $D(B - H^+) = 198.8 +- 2$ kcal/mol is determined from which $D(R^+ - Br^-) = 146.8 +- 2.3$ kcal/mol is calculated for norbornyl cation, 16 kcal/mol less than for cyclopentyl cation. In several cases additional thermochemical data useful in assessing absolute $D(R^+ - Br^-)$ heterolytic bond dissociation energies are provided by photoionization mass spectrometry. Relative enthalpies of solvation for carbenium ions are estimated via appropriate thermochemical cycles by combining the gas phase data with heats of ionization in a HSO_3F/SbF_5 medium. The results show that solvation enthalpies are related to ion size with smaller ions being better solvated. Relative stabilities of cyclic bromonium ions are the same in the gas phase and solution. Stability increases with increasing ring size and in the three-membered rings with methyl substitution. However, solvent has an appreciable effect in attenuating the observed range.

7172 Base strength of amines at high temperatures. Ionization of cyclohexylamine and morpholine. Mesmer, R.E.; Hitch, B.F. (Oak Rige National Lab., TN). *J. Solution Chem.;* **6**: No. 4, 251-261(Apr 1977).

A potentiometric technique using a hydrogen electrode concentration cell with flowing solutions was employed to measure the ionization equilibria of cyclohexylamine and morpholine over the temperature range 50 to 295°C in dilute KCl media. Also, the isothermal pressure coefficients were determined to 250°C in the same media. Smoothing functions are presented which fit these and other selected data, and thermodynamic quantities for the ionization process were derived. Nearly linear variation of ΔH vs $T\ \Delta S$ was observed for this process as well as other similar reactions, and the significance is discussed. Differences in basicities of amines are found to decrease at elevated temperatures, and reversals in relative base strengths are seen.

7173 (BNWL-tr—267) Infrared spectra of linear and cross-linked polyelectrolytes. Lindeman, J. Translated from *Zesz. Nauk. Politech. Wroclaw., Chem.;* **22**: No. 204, 3-17, 27-35, 60-72(1969). 54p. Dep. NTIS, PC A04/MF A01.

An attempt was made to interpret ir spectra (in the range 500 to 3500 cm^{-1}) of linear and cross-linked polystyrene polyelectrolytes on the basis of correlation tables and by comparison with the spectra of low-molecular standards. The preparations were analyzed photometrically with a Zeiss UR 10 spectrophotometer. The samples to be photographed were prepared using pressing of potassium bromide pellets and the sedimentation and lyophilization technique. Spectra of unmodified styrene-divinylbenzene copolymers as well as linear and cross-linked chloromethylated derivatives - intermediate products in the synthesis of polyelectrolytes and polystyrene ion exchangers - were obtained and investigated. A quantitative test was made to estimate the cross-linking component in the styrene-divinylbenzene copolymers by means of spectrophotometry, and the possibility of identifying anomalous structural elements of polystyrene ion exchangers on the basis of ir spectra was analyzed.

ISOTOPE EFFECTS

REFER ALSO TO CITATION(S) 7162

ISOTOPE EXCHANGE AND ISOTOPE SEPARATION

7174 (MLM—2450) Mound Laboratory activities in chemical and physical research: January—June 1977. (Mound Lab., Miamisburg, Ohio (USA)). 4 Oct 1977. Contract EY-76-C-04-0053. 54p. Dep. NTIS, PC A04/MF A01.

Activities are reported in research programs on computer operations, isotope separation, low temperature phenomena, metal hydrides, separation chemistry, and separation methods. (JRD)

ELECTROCHEMISTRY

7175 (LBL—6174) Electron transfer at sensitized semiconductor electrodes. Spitler, M.T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1977. Contract W-7405-ENG-48. 150p. Dep. NTIS, PC A07/MF A01.

Thesis.

Electron transfer from the excited state of sensitizing dyes to the conduction band of semiconductors has been studied through photoelectrochemical techniques. Two systems were analyzed in detail: rhodamine B on ZnO and rose bengal on TiO_2. Prior to electrochemical experimentation, the adsorption characteristics of these dyes were investigated using ZnO, ZnS, and TiO_2 single crystals as substrates. Absorbance measurements of the adsorbed dye were taken as a function of the solution concentration of the dye. Adsorption isotherms heats of adsorption were also established; they were similar to literature data reported for adsorption of these dyes on powdered substrates. Using the absorbance data, the quantum efficiency for photoinjection of electrons from rhodamine B into a ZnO electrode was determined to be 2.7×10^{-2}. This value was independent of the dye surface concentration down to 50% coverage of the electrode. With the assumption that not all of the rhodamine B adsorbed on the electrode has the same rate of electron injection, a kinetic model for the time decay of the photocurrent was developed; data were analyzed according to this theory. A rate constant for photoreduction of the adsorbed dye was determined for the reducing agents. 86 references.

PHOTOCHEMISTRY

REFER ALSO TO CITATION(S) 7340, 7341, 7342, 7343, 7344, 7346, 7347, 7348, 7349, 7350, 7351, 7352, 7353, 7354, 7356, 7357, 7358, 7359, 7360, 7361, 7362, 7365, 7366, 7367, 7368, 7369, 7370, 7371, 7372, 7373, 7374, 7375, 7376, 7377

RADIATION CHEMISTRY

REFER ALSO TO CITATION(S) 7168, 7355, 7377

7176 **Radiation chemistry of aqueous cyanide ion.** Bielski, B.H.J.; Allen, A.O. (Brookhaven National Lab., Upton, NY). *J. Am. Chem. Soc.;* **99**: No. 18, 5931-5934(31 Aug 1977).

Dilute KCN solutions, irradiated with γ rays in the presence of N_2O, give radicals $CONH_2$ which react quantitatively by disproportionation to yield equal amounts of cyanate and formamide. In the absence of N_2O, the radicals $CONH_2$ and H_2CN are formed and interact to yield a more complicated spectrum of products.

RADIOCHEMISTRY AND NUCLEAR CHEMISTRY

HOT-ATOM CHEMISTRY

7177 (ORO—3602-18) **Reactions of charged and neutral recoil particles following nuclear transformations. Progress report No. 11, September 1976—August 1977.** Ache, H.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemistry). Sep 1977. Contract EY-76-S-02-3602. 30p. Dep. NTIS, PC A03/MF A01.

The status of the following programs is reported: study of the stereochemistry of halogen atom reactions produced via (n,γ) nuclear reactions with diastereomeric molecules in the condensed phase; decay-induced labelling of compounds of biochemical interest; reactions of energetic tritium species in graphite; and positron lifetime measurements in γ-irradiated organic solids. (LK)

7178 **Effects of solvent-solute interactions on the stereochemical course of the high-energy chlorine-38 for chlorine substitution process in diastereomeric dichloroalkanes in the condensed phase.** Wu, J.L.; Ache, H.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *J. Am. Chem. Soc.;* **99**: No. 18, 6021-6027(31 Aug 1977).

The stereochemistry of the high-energy chlorine-38 for chlorine substitution process was studied in diastereomeric 2,4-dichloropentane and 2,3-dichlorobutane in solutions. The experimental results indicate that the stereochemical course of the substitution process is predominantly and directly controlled by the properties of the solvent molecules, specifically by the dielectric constant, which in turn is responsible for the magnitude of intermolecular interaction between reactants and solvents. It appears that strong intermolecular interaction favors substitution via retention of configuration, whereas in solvents having a low dielectric constant the retention/inversion ratio decreases.

PROPERTIES OF RADIOACTIVE MATERIALS

REFER ALSO TO CITATION(S) 7177, 7419, 7420, 7421, 7432, 7508, 7512, 7515

7179 (CONF-770662—3) **Comparison of the thermodynamic properties and high temperature chemical behavior of lanthanide and actinide oxides.** Ackermann, R.J.; Rauh, E.G. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 55p. Dep. NTIS, PC A02;MF A01.

From International colloquium on refractory oxides for high temperature energy sources; Odeillo, France (28 Jun 1977).

The thermodynamic properties of the lanthanide and actinide oxides are examined, compared, and associated with a variety of high temperature chemical behavior. Trends are cited resulting from a number of thermodynamic and spectroscopic correlations involving solid phases, species in aqueous solution, and molecules and ions in the vapor phase. Inadequacies in the data and alternative approaches are discussed. The characterization of nonstoichiometric phases stable only at high temperatures is related to a network of heterogeneous and homogeneous equilibria. A broad perspective of similarity and dissimilarity between the lanthanides and actinides emerges and forms the basis of the projected needs for further study.

7180 (COO—1515-79) **Exchange of lyotropic series cations by micaceous vermiculite and its weathering products determined by electron microscopy and radiochemical analysis. Progress report, August 1, 1974—October 31, 1977.** Jackson, M.L.; Helmke, P.A. (Wisconsin Univ., Madison (USA)). 1977. Contract EY-76-S-02-1515. 34p. Dep. NTIS, PC A03/MF A01.

Determination of layer charge of micas by ^{235}U fission particle tracks (thermal neutron activated) was completed by a development of a unique method of UO^{2+} saturation at pH 2.4 and removal of excess salts physically. The U content and age-dating of soil micas was also accomplished by fission particle counting. Thermodynamic metastability of micaceous vermiculite in soils with reversible mica-vermiculite reactions were found to result in extremely tenacious natural fixation of Cs^+ in soil fine fractions and weathering rock, a model for $^{137}Cs^+$ retention. Visual models for Cs^+ fixation were obtained as structural layer images of micaceous vermiculite wedges in clays, including kaolinites. Diverse divalent cations were found to adsorb specifically (i.e., in 1M $NaNO_3$) on hydrous oxides of Fe and Al, materials common in soils and capable of "holding up" $^{90}Sr^{2+}$, $^{45}Ca^{2+}$, and other fission products from free movement in groundwaters. Aerosol size quartz (1 to 10 μm), from dusts containing Cs^+ fixing micaceous vermiculites, was characterized by oxygen isotopic ratio analysis and the ratios found useful in tracing dust provenance. Quartz of chert origin was revealed electron microscopically as clusters of fine subhedral crystals. Of the 20 elements measured in Cretaceous shales La, Sm, Ba, and Hf showed trends in concentration from igneous shore line to central basin, correlative with change in oxygen isotopic ratio.

7181 (NAS-NS—3061) **Radiochemistry of bismuth.** Bhatki, K.S. (Tata Inst. of Fundamental Research, Bombay (India)). Sep 1977. 148p. Dep. NTIS, PC A07/MF A01.

A review is presented of the nuclear and chemical features of particular interest to the radiochemist. A discussion of important analytical procedures such as precipitation, solvent extraction, ion exchange, paper chromatography, electroanalytical separations, and volatilization is included, together with gravimetric, volumetric, and photometric methods and a discussion on problems of dissolution of a sample. Also included are various radioactivity counting techniques and a collection of radiochemical procedures for bismuth as found in the literature. (JRD)

7182 (NAS-NS—3062) **Radiochemistry of iodine.** Kahn, M.; Kleinberg, J. (Argonne National Lab., Ill. (USA); New Mexico Univ., Albuquerque (USA); Kansas Univ., Lawrence (USA)). Sep 1977. 109p. Dep. NTIS, PC A06/MF A01.

The preparation of isotopes of the element, with selected procedures for its determination in or separation from various media is described along with the separating of iodine species from each other. Each part of the introductory section is referenced separately from the remainder of the monograph. For the preparative and analytical sections there is an extensive, indexed bibliography which was developed from the indexes of Volumes 19 to 30 inclusive (1965-1974) of Nuclear Science Abstracts (NSA). From these indexes the NSA abstracts of possible pertinent references were selected for examination and a choice was made of those references which were to be included in the bibliography. The bibliography has both primary and secondary references. Although the monograph does not cover hot atom chemistry, the kinetics of exchange reactions, decay schemes, or physiological applications, papers in these areas were examined as possible sources of useful preparative and analytical procedures. (JRD)

7183 **Substituted uranocenes with alkoxy and amino groups.** Harmon, C.A.; Bauer, D.P.; Berryhill, S.R.; Hagiwara, K.; Streitwieser, A. Jr. (Univ. of California, Berkeley). *Inorg. Chem.;* **16**: No. 9, 2143-2147(Sep 1977).

The following derivatives of uranocene, di-eta^8-cyclooctatetraeneuranium, $U(C_8H_7R)_2$, R = H (1), are described: R = OCH_3 (2), OCH_2CH_3 (3), $OC(CH_3)_3$ (4), $OCH_2CH = CH_2$ (5), $N(CH_3)_2$ (6), $CH_2N(CH_3)_2$ (7), $(CH_2)_3N(CH_3)_2$ (8), $N^+(CH_3)_3I^-$ (9), $CH_2N^+(CH_3)_3I^-$ (10). Thermal Claisen rearrangement of the allyloxy compound 5 has not been observed. The ether 2 and ammonium salt 9 react with alkylithium reagents to give the corresponding dialkyluranocene apparently by a metalation chain reaction involving a cyclooctatrienyneuranium intermediate. Internal coordination of uranium by nitrogen in 7 and 8 is not significant.

7184 **Kinetic study of the reduction of neptunium (VII) and americium (VI) by bromide ion in aqueous perchlorate media.** Cooper, J.N.; Woods, M.; Sjoblom, R.; Sullivan, J.C. (Argonne National Lab., IL). *Inorg. Chem.;* **16**: No. 9, 2267-2270(Sep 1977).

The oxidation of Br- to bromine by the actinides, Am(VI) and Np(VII), has been found to proceed by the rate laws $-\frac{1}{2}(d \ln [Am(VI)]/dt) = k_1[Br^-] + k_2[Br^-]^2$ and $-d \ln [Np(VII)]/dt = [Br^-](k_1[H^+] + k_2[H^+]^2)$. The apparent activation parameters are $\Delta H_1^{++} = 15.7 +- 0.1$ kcal/mol, $\Delta H_2^{++} = 12.5 +- 0.1$ kcal/mol, $\Delta S_1^{++} = 2.5 +- 2.7$ eu, and $\Delta S_2^{++} = -1.5 +- 1.6$ eu for Am(VI) and $\Delta H_1^{++} = 9.4 +- 0.3$ kcal/mol, $\Delta H_2^{++} = 3.9 +- 0.5$ kcal/mol, $\Delta S_1^{++} = -8.8 +- 1.1$ eu, and $\Delta S_2^{++} = -26.3 +- 1.8$ eu for Np(VII). The rate laws are accounted for by mechanisms consistent with other oxidations of Br^- and are compared with similar rate laws observed for the dioxo cation, VO_2^+.

7185 (GAT-Z—5049) **Corrosion by uranium hexafluoride. Part 2.** Dixmier, J.; Hasson, R.; Maraval, S.; Vincent, L.M. Translated by R.A. Rapp from *J. Nucl. Mater.;* **5**: No. 2, 200-207(1962). 18p. Dep. NTIS, PC A02/MF A01.

The employment of discontinuous measurements, dictated by the nature of the objectives in view, led the authors to analyze the sources of the scatter in these measurements. The principal sources are: machining of samples, weighing errors and temperature variations. The scatter due to each of these factors has been compared with the total scatter of the results. This comparison shows that the results are reproducible and that the accuracy remains good over a wide range of values. In conclusion, the method described permits measurements of high sensitivity (some millimicrons of penetration) of attack by UF_6 or other corrosive agents, under the tried conditions of an industrial laboratory.

RADIOISOTOPE PRODUCTION

7186 (ORNL—5305) **Transuranium Processing Plant semiannual report of production, status, and plans for period ending December 31, 1976.** King, L.J.; Bigelow, J.E.; Collins, E.D. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 29p. Dep. NTIS, PC A03/MF A01.

During the period July 1, 1976, through December 31, 1976, transuranium elements were obtained from 11 irradiated HFIR targets; products recovered are 0.3 g ^{243}Am, 16.6 g ^{244}Cm, 23 g ^{249}Bk, 211 g ^{252}Cf, 1.15 mg ^{253}Es, and 0.4 pg ^{247}Fm. Two batches of high-purity ^{248}Cm were purified chemically for shipment, and another batch containing about 62 mg of ^{248}Cm was separated from ^{252}Cf. Thirty shipments were made from TRU during the period; recipients and the amounts of nuclides are listed in tabular form. Nine HFIR targets, each containing 8 to 9 g of curium, were fabricated. The sequence of chemical processing steps used to purify the californium product was changed; this change yielded a shorter recovery time for high-purity ^{253}Es, which enabled a 50% increase in the amount obtained. Eight neutron sources were fabricated during this report period, bringing the total fabricated to date to 92. Three sources that had previously been returned to TRU were reassigned; two others are also available for reassignment. The values currently being used for transuranium element decay data and for cross-section data in planning irradiation-processing cycles, calculating production forecasts, and assaying products are tabulated in the Appendix.

COMBUSTION CHEMISTRY

REFER ALSO TO CITATION(S) 7364

7187 (SAND—77-1115C) **Enhanced spontaneous Raman scattering technique for highly luminous environments.** Mulac, A.J.; Flower, W.L.; Hill, R.A.; Aeschliman, D.P. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 20p. (CONF-771015—1). Dep. NTIS, PC A02/MF A01.

From Fall meeting of the Western States Section of the Combustion Institute; Palo Alto, California, USA (17 Oct 1977).

A gated photon counting system, cavity-dumped argon ion laser, and a multipass retro-reflecting light cell have been combined in a system to enhance spontaneous Raman scattering in luminous background situations. Signal-to-background ratio (S/B) has been improved a factor of 450 over a single-pass cw system with cw power equal to the pulsed average power. The improvement attributable to the gating and cavity dumping the laser is a factor of 30. A factor of 15 improvement is due to the retro-reflecting light trap. Temperature and density data from a luminous methane/air flame are presented to illustrate the utility of the system.

7188 **Cesium-133 nuclear magnetic resonance study of the complexation of cesium tetraphenylborate by 18-crown-6 in pyridine solutions.** Mei, E.; Dye, J.L.; Popov, A.I. (Michigan State Univ., East Lansing). *J. Am. Chem. Soc.;* **99**: No. 16, 5308-5311(3 Aug 1977).

Cesium-133 nuclear magnetic resonance was used as a probe of the interaction of Cs^+ with the macrocyclic polyether 18-crown-6 (18C6) in pyridine solutions. A study of the ^{133}Cs chemical shift as a function of crown/Cs^+ mole ratio showed that the complexation reaction occurs in two steps—formation of a stable 1:1 complex ($K_1 \sim 10^6$ at 298°K) followed by the addition of a second ligand molecule to form a sandwich compound, $Cs^+(18C6)_2$ ($K_2 = 44 +- 2$ at 298°K). The thermodynamic functions for the second step are: $(\Delta G^0_2)_{298} = -2.58 +- 0.02$ kcal mol^{-1}, $\Delta H^0_2 = -5.8 +- 0.2$ kcal mol^{-1}, and $\Delta S^0_2 = -10.7 +- 0.6$ cal mol^{-1} deg^{-1}. Line-shape analysis of the ^{133}Cs resonance at various temperatures gave rate parameters for the decomplexation of the 1:1 complex as follows: $\Delta H/$sup double dagger/ $= 7.8 +- 0.1$ kcal mol^{-1}, $\Delta S/$sup double dagger/ $= -14.3 +- 0.4$ cal mol^{-1} deg^{-1} and $(\Delta G/$sup double dagger/$)_{298} = 12.02 +- 0.02$ kcal mol^{-1}.

ENGINEERING

GENERAL ENGINEERING

7189 **Future improvements for standards, specifications and codes.** Willcox, R.S. (Partner, Ruck, Willcox and Partners, Epsom, England). pp A125-A132 of In Addendum to the proceedings of the conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings. Newman, P. (ed.). Lafayette, IN; Purdue Research Foundation (1975).

From Conference on improving efficiency in HVAC equipment and components for residential and small commercial buildings; Lafayette, Indiana, USA (7 Oct 1974).

See CONF-741010—P2.

The extent to which European standards and specifications are currently undergoing radical changes which affect designers, engineers, and consumers involved in the building industry is discussed. The significance of these changes to countries which have not previously used metric measurements and the improved interchangeability of equipment manufactured in different countries are described. (LCL)

FACILITIES AND EQUIPMENT

REFER ALSO TO CITATION(S) 7008, 7032, 7383, 7498, 7521, 7582, 7583

7190 (SAND—75-0208) **Kalman approach to continuously sensor-aided inertial guidance.** Hostetler, L.D. (Sandia Labs., Albuquerque, N.Mex. (USA)). May 1975. Contract EY-76-C-04-0789. 38p. Dep. NTIS, PC A03/MF A01.

The application of Kalman-filtering techniques in continuously updating an intertial navigation system with auxiliary-sensor measurement data is investigated. The optimal updating is accomplished by a recursive Kalman filter that continuously updates the intertial navigation system all the way from a vehicle release or identification point (IP) to the target. The Kalman filter utilizes a stored strip of auxiliary-sensor measurement data along the desired vehicle trajectory. Accelerometer bias errors and gyro drift errors are modeled in the guidance equations along with the initial position, velocity and attitude errors of the inertial navigation system. The case of using a radar altimeter as an auxiliary sensor is presented as an example.

7191 (SAND—75-0299) **Analysis of a terrain-aided inertial navigation system.** Hostetler, L.D. (Sandia Labs., Albuquerque, N.Mex. (USA)). Sep 1975. Contract EY-76-C-04-0789. 24p. Dep. NTIS, PC A02/MF A01.

A new terrain-guidance system based on a Kalman approach to continuously sensor-aided inertial guidance is analyzed. At the heart of the system is a Kalman filter that continuously processes radar terrain-clearance data to optimally update a conventional inertial navigator. The analysis indicates that this new system is superior to certain other terrain-guidance schemes in terms of terminal accuracy as well as computation time and memory requirements.

7192 (SAND—77-8633A) **Comparison of flight test results and 6-DOF calculations using the incremental coefficient method for store releases from the F-111 weapons bay.** Everett, R.N. (Sandia Labs., Livermore, Calif. (USA)). 1977. Contract EY-76-C-04-0789. 28p. (CONF-771050—2). Dep. NTIS, PC A02/MF A01.

From 4. JTCG aircraft/stores compatibility symposium; Ft. Walton, Florida, USA (12 Oct 1977).

Wind tunnel incremental coefficient data were used to calculate the six degree of freedom motion of a 2400 pound store being released from the weapons bay of the F-111 aircraft. Subsequent flight test results have been compared with these calculations to show an excellent agreement over an airspeed range of 300 to 500 KCAS. Additional flights will provide comparisons up to approximately 650 KCAS. The comparisons to date indicate that the simplified grid simulation method gives a very reasonable prediction of the motion for weapon bay releases of low static margin stores. Of special interest is the method for obtaining the incremental aerodynamic coefficients inside the weapons bay which is detailed.

7193 (UCID—17567) **Plane strain large deformation analysis of this cylindrical shell subject to external pressure.** Lu, S.C.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1977. Contract W-7405-ENG-48. 17p. Dep. NTIS, PC A02/MF A01.

Included in this report are the analytical results of a plane strain large displacement analysis of a thin cylindrical shell subjected to nonuniform external pressure. The purpose of the analysis is to determine the ultimate load capacities and hence, the design margins of safety of the shell structure for both the static and the dynamic loading conditions. The finite element method was used to solve the

numerical problem. For dynamic analysis, the implicit Houbolt operator was utilized to perform the time integration. All numerical computations were accomplished using the nonlinear finite element program MARC. The analysis is one of the tasks required for the technical assistance program "Safety Margin Associated with Containment Structures Under Dynamic Loading."

7194 (UCRL—52225) **Validation and calibration of the LLL Transient Electromagnetic Measurement Facility.** Bevensee, R.M.; Deadrick, F.J.; Miller, E.K.; Okada, J.T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Mar 1977. Contract W-7405-ENG-48. 56p. Dep. NTIS, PC A04/MF A01.

Recent developments in short-pulse nanosecond technology have enabled the measurement of electromagnetic phenomena (e.g., electromagnetic pulse, EMP) over instantaneous bandwidths of 100:1 or more. Measurements can be made of circuit quantities such as input impedance and effective height, as well as of radar cross section, and surface current. The measurement procedure described herein for the LLL Transient Electromagnetics Measurement Facility (Range) is being used to validate computer codes for EMP coupling and to develop a data base for canonical problems whose numerical solutions are impractical or impossible to obtain.

7195 (UCRL—78765) **Numerical procedure for three-dimensional impact problems.** Hallquist, J.O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1977. Contract W-7405-ENG-48. 31p. (CONF-771027—1). Dep. NTIS, PC A03/MF A01.

From American Society of Civil Engineers annual convention; San Francisco, California, USA (17 Oct 1977).

The development described was undertaken to provide DYNA3D with the capability necessary to solve three-dimensional impact problems and constitutes and extension of previous work in two space dimensions. DYNA3D is a finite deformation explicit finite element code that permits spatial discretization with three classes of elements including eight node constant stress hexahedrons, variable node (8 to 20) hexahedrons, and twenty-seven node Lagrange hexahedrons. Few formulations exist that consider both impact and the finite deformations that may result. The paper is divided into four sections. In the first section a brief description of the finite element method is given, mainly to provide a perspective and basis for the development that follows. In the second section the formulation is discussed in some detail. An example is shown in the third section. Conclusions are given in the final section.

7196 (UCRL—79591) **Computer simulations of high pressure systems.** Wilkins, M.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Jul 1977. Contract W-7405-ENG-48. 16p. (CONF-770706—30). Dep. NTIS, PC A02/MF A01.

From 6. AIRAPT international high-pressure conference; Boulder, Colorado, United States of America (USA) (25 Jul 1977).

Numerical methods are capable of solving very difficult problems in solid mechanics and gas dynamics. In the design of engineering structures, critical decisions are possible if the behavior of materials is correctly described in the calculation. Problems of current interest require accurate analysis of stress-strain fields that range from very small elastic displacement to very large plastic deformation. A finite difference program is described that solves problems over this range and in two and three space-dimensions and time. A series of experiments and calculations serve to establish confidence in the plasticity formulation. The program can be used to design high pressure systems where plastic flow occurs. The purpose is to identify material properties, strength and elongation, that meet the operating requirements. An objective is to be able to perform destructive testing on a computer rather than on the engineering structure. Examples of topical interest are given.

CRYOGENIC AND SUPERCONDUCTING EQUIPMENT AND DEVICES

REFER ALSO TO CITATION(S) 6814, 7247, 7265, 7275, 7276, 7281, 7284, 7285, 7286, 7757, 7758, 7761, 7762

7197 **Digital simulation of transients in a turbo-alternator with superconducting field winding.** Fuersich, H. (Tech Univ, Munich, Ger). *Arch. Elektrotech.* [*Berlin*]; **59**: No. 3, 153-161(May 1977). (In German).

For a simplified mathematical model of a turboalternator with a superconducting-field winding the fundamental wave of the magnetic field is calculated two-dimensionally with no restrictions concerning the time-dependence of the currents. In the beginning the solid rotor parts and the shields between field and stator winding are replaced by symmetrical squirrel-cages. If the magnetic flux linkages and the electromagnetically generated torques are analyzed, a set of nonlinear differential equations results describing the behavior of the alternator. By means of a digital simulation program it is integrated for transients. 27 refs.

7198 (LA-tr—77-54) **Operating manual. Stabilized rectifier for an electromagnet, 5 volts-300 amps.** (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Translation of a French report. 35p. Dep. NTIS, PC A03/MF A01.

The power supplies were especially designed to supply superconducting samples and electromagnets. They accomplish the rise in current in the load at a constant rate whose value is controlled automatically. In addition, they ensure a slow decrease in current in the electromagnet should there be a cut in the power supply network or a break in the circuit due to an internal or external fuse.

PROTECTIVE STRUCTURES AND EQUIPMENT

7199 **Improving the performance of fabric filters.** Lamb, G.; Costanza, P. *Chem. Eng. Prog.*; **73**: No. 1, 51-53(Jan 1977).

Application of electric fields to fabric filters appears to be promising as a means for improving control of respirable particulate pollutants and for reducing the pressure drop across the filter. The use of fabrics with modified fiber geometries also appears promising. However, little benefit can be derived from the use of both techniques simultaneously. For the filtration of dust of high resistivity, enhancement of captive efficiency by electrical means would involve negligible increases in power consumption.

SHIPPING CONTAINERS

7200 (ORNL/ENG/TM—3) **Safety analysis report for packaging: the ORNL tungsten-shielded cask.** Evans, J.H.; Levine, D.L.; Just, R.A. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 97p. Dep. NTIS, PC A05/MF A01.

The ORNL tungsten-shielded cask was designed and fabricated at the Oak Ridge National Laboratory (ORNL) for the transport of Type B and large quantity nonfissile isotopes. The container was evaluated analytically to determine its compliance with the applicable regulations governing containers in which radioactive and fissile materials are transported. Computational methods were employed in a determination of the structural integrity and thermal behavior of the cask relative to the general standards for normal conditions of transport and to the standards for the hypothetical accident conditions. The results of these evaluations demonstrate that the container is in compliance with the applicable regulations.

7201 (ORNL/ENG/TM—4) **Safety analysis report for packaging: the ORNL uranium-shielded shipping cask.** Boulet, J.A.; Evans, J.H.; Chipley, K.K. (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 168p. Dep. NTIS, PC A09/MF A01.

The ORNL uranium-shielded shipping casks, models L and M, are type B packages for large-quantity radioactive material shipments. There are seven casks altogether: six model L's and one model M. The model L casks are identified by Oak Ridge National Laboratory (ORNL) as 14 UC, Nos. 2, 3, 4, 5, 6, and 7; and model M is identified as 13 UC-1. Materials to be shipped in the casks are nonfissile radionuclides. The casks are similar, model L being slightly larger than model M. Both casks were fabricated at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, using the same general fabrication techniques.

7202 (ORNL/ENG/TM—8) **Safety analysis report for packaging: the ORNL lithium hydroxide fire and impact shield.** Evans, J.H.; Eversole, R.E.; Just, R.A. (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 139p. Dep. NTIS, PC A07/MF A01.

The ORNL lithium hydroxide fire and impact shield was designed and fabricated at Oak Ridge National Laboratory to permit the transport of Type B and large quantities of radioactive material and limited quantities of fissionable material. The shield was evaluated analytically and experimentally to determine its compliance with the applicable regulations governing containers in which radioactive and fissile materials are transported, and that evaluation is the subject of this report. Computational and test procedures were used to determine the structural integrity and thermal behavior of the shield relative to the general standards for normal conditions of transport and the standards for the hypothetical accident conditions. The results of the evaluation demonstrate that the shield is in compliance with the applicable regulations.

7203 (ORNL/ENG/TM—9) **Safety analysis report for packaging: the ORNL HFIR unirradiated fuel element shipping container.** Evans, J.H.; Boulet, J.A.M.; Eversole, R.E. (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 91p. Dep. NTIS, PC A05/MF A01.

The ORNL HFIR unirradiated fuel element shipping container was designed and fabricated at the Oak Ridge National Laboratory for the transport of HFIR unirradiated fuel elements. The container was evaluated analytically and experimentally to determine its compliance with the applicable regulations governing containers in which radioactive and fissile materials are transported, and the evaluation is the subject of this report. Computational and test procedures were used to determine the structural integrity and thermal behavior of the cask relative to the general standards for

normal conditions of transport and the standards for the hypothetical accident conditions. The results of the evaluation demonstrate that the container is in compliance with the applicable regulations.

MINING AND DRILLING EQUIPMENT AND FACILITIES

7204 (SAND—77-0523C) **Terradynamic technology: theory and experiment.** Chabai, A.J.; Young, C.W.; Yarrington, P.; Patterson, W.J.; Byers, R.K. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 27p. (CONF-771105—1). MF A01.

From 14. annual meeting of the Society of Engineering Science; Bethlehem, Pennsylvania, USA (14 Nov 1977).

In the investigation of earth penetration by projectiles, new experimental techniques, refined constitutive models, and multidimensional wave codes are providing insights into the complex mechanisms which control the motion of projectiles during their subterranian trajectories.

7205 **Well control valve apparatus.** Crowe, T.L. (to Baker Oil Tools, Inc.). US Patent 4,039,031. 2 Aug 1977. Filed date 26 Jan 1976. 10p.

A well control valve to be installed in a tubing string for use in killing a well through use of fluid under pressure pumped down through the annulus surrounding the tubing string is described. When the annulus pressure exceeds a predetermined value, the valve is opened to permit the kill fluid to flow into and through the tubing string into the producing formation. The valve contains a closure member or disc, the upstream side of which is subject to the normal hydrostatic pressure of the fluid in the annulus, and also to an increase in the pressure of the annulus fluid above normal hydrostatic pressure, but its downstream side is subjected to atmospheric pressure initially. Accordingly, the closure member can be placed in its opened condition, as by rupturing it, when subjected to a predetermined increase in annulus pressure above the normal hydrostatic pressure, allowing the annulus kill fluid to flow into and through the tubing string to the producing formation.

7206 **Functional relationships of effective factors in rotative small-caliber drilling.** Ziegler, K.; Eichmeyer, H. *Glueckauf-Forschungsh.;* **37**: No. 2, 55-59(Apr 1976). (In German).

Regression analysis is used to find practically useable equations to calculate drilling speed, power requirement, and volumetric material displacement from measured or assessable data. Drillability, borehole length and diameter, and speed calculations from regression functions are demonstrated. 14 refs.

LASERS

REFER ALSO TO CITATION(S) 6626, 7774, 7775, 7776

7207 (UCRL—13746) **Research studies on short optical pulse generation for the laser fusion program. Final report, 11 January 1976—11 March 1977.** Kuizenga, D.J. (Stanford Research Inst., Menlo Park, Calif. (USA)). 30 Mar 1977. Contract EY-76-C-03-0115-104. 23p. Dep. NTIS, PC A02/MF A01.

The single pulse energy that can be expected from a Nd:YAG laser was calculated. The factors limiting the pulse energy are discussed. It was shown that single pulse energies in the range of 0.1 to 1 mJ can reasonably be expected from this type of laser, with Nd:YAG as the active medium. (MOW)

7208 (Y/DA—7096) **LASL laser mirror program. Excerpts from Y-12 Development Division technical progress reports period ending March 1, 1977.** Thompson, C.H. (comp.). (Oak Ridge Y-12 Plant, Tenn. (USA)). Aug 1977. Contract W-7405-ENG-26. 37p. Dep. NTIS, PC A03/MF A01.

Analysis has been made of four fixture designs for supporting lightweight substrates during diamond turning. The analysis indicates that a flexible member should exist between the fixture and substrate. Also, bending stresses should be avoided, if possible. A recent design change in LASL's High Energy Gas Facility (HEGLF) has eliminated the need for lightweight substrates. However, use of nonaxisymmetric shapes requires the need for further development effort.

7209 **e-beam spreading and resulting field variations in CO_2 laser plasmas.** Cason, C.; Perkins, J.F.; Werkheiser, A.H.; Duderstadt, J. *AIAA [8] Am. Inst. Aeronaut. Astronaut.[9] J.;* **15**: No. 8, 1079-1083(Aug 1977).

From AIAA 15th aerospace sciences meeting; Los Angeles, CA, USA (24 Jan 1977).

Experimental measurements and theoretical analysis of e-beam spreading in pulsed CO_2 lasers have been performed at 1 atm. An explicit set of equations were developed to describe the e-beam energy deposition, including electron range enhancement effects. Spatial variations of resulting drift current density and applied field were therefore easily determined. A 10 l volume discharge was controlled by a 0.4 A/cm² 175 kV e-beam. Experimental values of the electron-ion recombination rate were experimentally determined for the 1/2/3 mixture of CO_2/N_2/He. The experimental I/V characteristic curves were correlated to the model for discharge current densities up to 50 A/cm².

7210 **Nanosecond switching and amplification of multiline HF laser pulses.** Getzinger, R.W. (Office of U.S. Senator P.V. Domenici, Washington, DC); Ware, K.D.; Carpenter, J.P.; Schott, G.L. *IEEE J. Quant. Electron.;* **QE-13**: No. 4, 97-100(Apr 1977).

Electrooptic gating and amplification of pulses with durations from 1 to 5 ns were accomplished with a pulsed HF chemical laser system using SF_6-hydrocarbon media and transverse-discharge energization. The system comprised an apertured, pin-discharge multitiline oscillator, a MgF_2 Rochon prism polarizer, a Pockels-effect, fast electrooptic switch, a 5 : 1 magnifying telescope, and a 22-mm dia. approximately 5-MW TEA amplifier, together with several arrangements of polarization analyzer elements. A 5-mm, square-sectioned electrooptic crystal of CdTe or $LiNbO_3$ yielded polarization contrast ratios of approximately 80 : 1 under zero and half-wave electric fields. Without other measures, this contrast in gated amplitude was diminished in passage through the partially gain-saturated amplifier. However, 80 : 1 amplitude contrast in the gated, amplified pulse was preserved when the full oscillator beam intensity was used continuously to control the amplifier gain. This was done either with a polarization discriminator placed downstream of the amplifier, or with the two polarized components from the gate taking separate directions, intersecting within the amplifier.

7211 **Pure rotational HF laser oscillations from exploding-wire laser.** Rice, W.W.; Oldenborg, R.C. (Los Alamos Scientific Lab., NM). *IEEE J. Quant. Electron.;* **QE-13**: No. 3, 86-88(Mar 1977).

Nineteen pure rotational HF laser transitions, 5 of which are new, from exploding-wire, metal atom oxidation lasers are reported. The laser operates at F_2 pressures as high as 500 torr and at a gain length of only 0.24 m. The laser pulses are 1—4 μs duration and deliver approximately 10^{-4} J/pulse.

7212 **Airbreathing gasdynamic lasers.** Hill, R.J.; Jewell, N.YT.; Jones, A.T.; Price, R.B. (Rolls-Royce (1971) Ltd., Derby, England). *J. Energy;* **1**: No. 2, 125-131(1977).

From 14. AIAA aerospace sciences meeting; Washington, DC, USA (26 Jan 1976).

The potential performance of an airbreathing gasdynamic laser (ABL) which burns common hydrocarbon fuels is investigated theoretically. In the ABL system examined air is compressed to a high pressure and enters the laser combustor at a temperature appropriate to an assumed value of polytropic efficiency. A hydrocarbon fuel is burned at the appropriate fuel-air ratio to produce the desired temperature and the products are expanded through two-dimensional minimum length contoured nozzles. The vibrational nonequilibrium flow through the nozzle is evaluated to determine the small signal gain and the maximum energy potentially available for extraction in the laser cavity downstream of the nozzles. Significantly high values are predicted for both parameters so that high specific power output should be feasible in a practical system. The theoretical predictions have been verified by making measurements of small signal gain in a small GDL rig, using stored fuels, oxidizer, and diluents.

7213 **Compact cylindrical CO_2 TEA laser.** Osche, G.R.; Sonntag, H.E. (Army Electronics Command, Fort Monmouth, NJ). *IEEE J. Quant. Electron.;* **12**: No. 12, 752-756(Dec 1976).

A cylindrical discharge scheme which utilizes a fine wire as the central electrode is investigated for compact CO_2 TEA laser applications. It is found that the strong radial dependence of electrical energy deposition into the plasma, a consequence of the large ratio of outer to inner electrode radii, produces a radial gain profile which is well localized in the center of the discharge tube. This allows for efficient matching of low-order stable optical modes to the active gain region while providing a high degree of mode selectivity in favor of these modes. Oscillation in the TEM_{01} Laguerre-Gaussian mode has been obtained at electrical efficiencies approaching 4 percent.

7214 **Specifications for a fusion laser.** Wilson, J.; Ham, D.O. (Univ of Rochester, NY). *Laser Focus;* **12**: No. 11, 38, 40-43, 45(Nov 1976).

Requirements for a fusion laser are given: pulse energy around 1 Mj and high average power. The energy requirement means that the laser must be large, with an active path-length of 3 to 10 meters. Most energy would be stored in an amplifier, and to avoid dumping of this energy by amplified spontaneous emission or parasitic oscillations the over-all small-signal gain should be less than 10^5. To obtain this value in such a long amplifier, the gain coefficient should be low, on the order of $g_0 = 4 \times 10^{-2}$ to 10^{-3} inverse centimeter. Another requirement is high efficiency. If G/sub F/ is less than 1/ $eta$$sub laser$, more energy is required to power the laser than is generated by fusion. For fusion gain of 100, this means laser efficien-

cy must be at least 1%, with powerplant output scaling linearly with the difference between fusion gain and the reciprocal of laser efficiency. Lower-efficiency lasers could be used in hybrid reactors, in which the neutrons produced by laser fusion in the pellet are amplified by fission in a blanket of uranium; the uranium could be of natural isotopic composition, or even depleted in fissionable ^{235}U.

7215 Laser glasses activated by neodymium and divalent metal metaphosphates as a base. Alekseev, N.E.; Iayneev, A.A.; Kopylov, Yu.L.; Kravchenko, V.B.; Rudnitskii, Yu.P.; Udovenko, N.F. *Zh. Prikl. Spektrosk.;* **24**: No. 6, 976-980(Jun 1976). (In Russian).

A study was made of the physical-chemical, thermo-optical, spectral-luminescent and generation characteristics of glasses containing neodymium in systems $Me(PO_3)_2$—$Al(PO_3)_3$, where Me = Mg, Ca, Sr, Ba, Zn, Cd or Pb. With increasing ionic radius of the metal (Me) there is ordinarily a decrease in the value of the thermo-optical constant W, the magnitude of dW/dt, the width of the luminescence bands and the resolution of the transition. A number of the characteristics of the phosphate glass LGS-I were measured, and it is shown that in generational properties this glass substantially exceeds the silicate glass GLS-1. (SJR)

7216 Theory of astigmatic laser resonators. Goncharenko, A.M.; Belousova, L.A. *Zh. Prikl. Spektrosk.;* **24**: No. 6, 981-984(Jun 1976). (In Russian).

A look is taken at the properties of an open laser resonator which is formed with astigmatic mirrors. It is shown that particular oscillations of this resonator are elliptical gaussian beams. The positions of the minima in the radial dimensions of the gaussian beam do not coincide in the mutually perpendicular, main planes of curvature of the mirrors. The phase surface of these beams is astigmatic; it can be cylindrical and even saddle-shaped. The parameters of the astigmatic resonator were determined, and the conditions were found for stability of its particular oscillations. (SJR)

7217 Optical excitation of carbon dioxide molecules. Sviridov, A.N.; Vol'ter, V.G.; Minaev, A.N. *Zh. Prikl. Spektrosk.;* **24**: No. 6, 1015-1021(Jun 1976). (In Russian).

It is shown it is possible to obtain inversions between the 00^01 and 10^00 levels with optical excitation of a number of levels V_1 V_2 V_3 (V_3 not equal to zero) of CO_2 molecules. Values of absorption coefficients are presented in liquid and gaseous carbon dioxide at wavelengths corresponding to a number of transitions 00^0-$V_1V_2V_3$ (V_3 not equal to zero). Calculations were made for amplification coefficients in various types of CO_2 lasers with optical pumping. Modes of pumping were determined. (SJR)

7218 Garnet laser with an optical-mechanical trap and with wavelength shift of 1.06 to 1.32 mkm radiation by changing the intensity of pumping. Kalintsev, A.G.; Khazov, L.D. *Zh. Prikl. Spektrosk.;* **24**: No. 6, 1073-1075(Jun 1976). (In Russian).

It is shown experimentally and theoretically that it is possible to "shift" the wavelength of radiation from a single-pulse garnet laser in a two-frequency resonator by varying the pumping intensity. On increasing the pumping above the threshold value, radiation with a wavelength of 1.064 mkm is generated, and starting with a certain value of intensity exceeding the threshold for the occurrence of 1.3188 mkm light, the 1.064 mkm light generation is suppressed, and only the 1.3188 mkm wavelength is generated. On the basis of the generational characteristics of the laser in a mode of constant Q-value of the resonator a determination was made of the cross-sections of a number of luminescence transitions, which satisfactorily coincided with subsequent measurements of these luminescent characteristics. The second harmonic of the 1.3188 mkm radiation at an efficiency of 15 percent, and yellow radiation of 0.59 mkm summed frequency were obtained. (SJR)

7219 Unit for the nanosecond, laser, pulse photolysis in the ultraviolet region for a combination of photochemical studies. Pikel'ni, V.F.; Kolosov, V.A.; Kiryukhin, Yu.I.; Kondrat'ev, V.A.; Borovkova, V.A.; Tarasov, E.N. *Zh. Prikl. Spektrosk.;* **24**: No. 6, 1080-1082(Jun 1976). (In Russian).

A description is given of a nanosecond laser unit for pulse photolysis in the ultraviolet region, by means of which it is possible to investigate the kinetics of the death of interstitial particles, their optical absorption and luminescence spectra, and also the photoconductivity induced by the laser radiation, at a time resolution of about 15 ns. As a source of powerful, stable uv-radiation, use is made of the fourth harmonic (266 nm) of radiation from an aluminum-yttrium garnet containing neodymium. The radiation power of the fourth harmonic attained 2 MW. The time of bringing the unit into the operating mode is considerably shortened because of the possibility of operating in a frequency mode. Absorption spectra of carbazole in hexane were obtained at 20°C. (SJR)

7220 Machinability aspects of diamond-turned metal optics. Arnold, J.B.; Steger, P.J.; Morris, T.O. (Oak Ridge Y-12 Plant, TN). pp 108-120 of In Proceedings of 19th SPIE annual technical symposium on design, manufacture and appreciation of metal optics, Vol. 65. Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (Aug 1975).

Some of the first work that was done to gather machinability data in order to better understand the mechanics of the diamond-turning process is described. Basic force data have been measured for the most common metals used in optical fabrication (electroplated gold, silver, OFHC copper, and 6061-T6 aluminum). In addition, force and surface deformation data were gathered on large and small-grained electroplated copper and electroplated nickel. Residual stress was measured as a function of the depth of cut in order to begin to understand how the history of the machining process could influence surface quality.

7221 Machining of optics: an introduction. Saito, T.T. (Air Force Weapons Lab., Kirtland AFB, NM). *Appl. Opt.;* **14**: No. 8, 1773-1776(Aug 1975).

The paper introduces machining of optics, presenting some of the history of machining progress, critical machining variables, material and geometrical capabilities, and some new results on optical evaluation of machined surfaces. A most significant development is electroplating of materials that are otherwise not presently machinable. For example, molybdenum has been electroplated with silver or gold and then successfully diamond turned. Research and development ideas for future machining studies are discussed.

7222 Fluctuation model of a passively mode-locked laser. Glenn, W.H. (United Aircraft Research Labs., East Hartford, CT). *IEEE J. Quant. Electron.;* **QE-11**: No. 1, 8-17(Jan 1975).

The "Fluctuation Model" for the generation of ultrashort pulses by a saturable absorber has been discussed by a number of authors. This model has provided valuable insights into the mechanisms involved in passive mode locking; however, previous treatments have been incorrect in several important respects. These treatments have attempted to describe the behavior of the laser in terms of the evolution of a statistically independent set of fluctuation (pulses) circulating in the laser. It is shown that such a description is impossible in principle. The paper discusses in detail the problem with the previous treatments and presents an alternate treatment of the evolution of the ultrashort pulses during the nonlinear phase of development. The model is capable of predicting the conditions under which good mode locking will occur, the probability of the appearance of secondary pulses and their relative intensities, the peak intensity of the output pulse train and its statistical variation, and the duration and time of appearance of the output pulse train. The analysis has also been formulated in such a way that the evolution of the signal can be followed by measurement of experimentally observable quantities.

7223 Diamond-turned mirrors. Bennett, H.E.; Soileau, M.J.; Archibald, P.C. (Naval Weapons Center, China Lake, CA). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 435, 49-56(1975).

Diamond-turned, micromachined metal mirrors offer a new approach to optical fabrication and may have significant advantages for use as laser components. A laser mirror must have (1) excellent optical figure, (2) low scattered light, (3) high reflectance, (4) high damage threshold, and (5) good environmental resistance. Optical figures as good as 1/20th wave over a 3.86-cm diameter sample and better than a wave over a 10.2-cm diameter sample on micromachined mirrors produced by Oak Ridge National Laboratories have been measured. Scattered light levels in the infrared can be as low or lower than those obtained on conventional mirrors and values as low as 2×10^{-5} have been observed at a wavelength of 10.6 μm. Infrared reflectance values as high or higher than those of conventional evaporated or sputtered coatings have been achieved and one mirror had an absorption at 10.6 μm of 0.006. The laser damage threshold of micromachined mirrors may well be higher than that obtainable by other techniques, but this question and the environmental resistance and "coatability" of a micromachined surface require further investigation.

7224 1.06μm 150 psec laser damage study of diamond turned, diamond turned/polished and polished metal mirrors. Saito, T.T.; Milam, D.; Baker, P.; Murphy, G. (Lawrence Livermore Lab., CA). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 435, 29-40(1975).

A well characterized 1.06 μm 150 psec glass laser pulse was used to study the damage characteristics for diamond turned, diamond turned/polished, and polished copper and silver mirrors less than 5 cm diameter. Although most samples were tested with a normal angle of incidence, some were tested at 45° with different linear polarization showing an increase in damage threshold for S polarization. Different damage mechanisms observed are discussed. Laser damage is related to residual surface influences of the fabrication process. First attempts to polish diamond turned surfaces resulted in a significant decrease in laser damage threshold. The importance of including the heat of fusion in the one dimensional heat analysis of the theoretical damage threshold and how close the samples came to the theoretical damage threshold are discussed.

7225 Direct interferometric measurements of the nonlinear refractive index coefficient N_2 in laser materials. Bliss, E.S.; Speck, D.R.; Simmons, W.W. (Lawrence Livermore Lab., CA). *Appl. Phys. Lett.;* **25**: No. 12, 728-730(15 Dec 1974).

To properly account for nonlinear propagation effects in the design of a large laser system, it is necessary to know the nonlinear refractive index coefficient n_2 of each system component. Values of n_2 for YAG, ED-2 laser glass, EY-1 Faraday rotator glass, and FR-4 rotator glass are given. The measurements were made at 1.06 μm using a time-resolved Mach—Zehnder interferometer to directly observe the variation of refractive index with intensity during the transmission of pulses 150 psec in duration.

7226 Propagation of a high-intensity laser pulse with small-scale intensity modulation. Bliss, E.S.; Speck, D.R.; Holzrichter, J.F.; Erkkila, J.H.; Glass, A.J. (Lawrence Livermore Lab., CA). *Appl. Phys. Lett.;* **25**: No. 8, 448-450(15 Oct 1974).

For laser beams of large aperture with power far above the critical power for self-focusing, nonlinear propagation instabilities lead to the growth of small-scale variations in intensity and phase. Measurements of the growth rate for interference fringes in unpumped ED-2 laser glass as a function of fringe spacing and intensity are reported. Calculations based on the simplest form of linearized small-scale instability theory agree approximately with the measured rates, and a more complete linearized treatment predicts the growth rates within experimental error.

7227 Streak camera investigation of the self-focusing onset in glass. Campillo, A.J.; Fisher, R.A.; Hyer, R.C.; Shapiro, S.L. (Los Alamos Scientific Lab., CA). *Appl. Phys. Lett.;* **25**: No. 7, 408-411(1 Oct 1974).

The onset of self-focusing in a glass sample has been studied with a streak camera. After passing through the sample, the beam is no longer focused by a subsequent lens into a nearly diffraction-limited spot, but rather into a time-dependent ring. A simple model explains these results and indicates practical limitations for uniformly illuminating small targets with a Nd:glass laser chain.

7228 Laser-induced electric breakdown in solids. Bloembergen, N. (Harvard Univ., Cambridge, MA). *IEEE J. Quant. Electron.;* **QE-10**: No. 3, 375-386(Mar 1974).

A review is given of recent experimental results on laser-induced electric breakdown in transparent optical solid materials. A fundamental breakdown threshold exists characteristic for each material. The threshold is determined by the same physical process as dc breakdown, namely, avalanche ionization. The dependence of the threshold on laser pulse duration and frequency is consistent with this process. The implication of this breakdown mechanism for laser bulk and surface damage to optical components is discussed. It also determines physical properties of self-focused filaments.

7229 Limitations on high peak power lasers. McMahon, J.M. (Naval Research Lab., Washington, DC). pp 307-310 of In IEDM technical digest. New York; Institute of Electrical and Electronics Engineers, Inc. (1974).

Observations of the onset of small scale self-focusing on the NRL laser system are compared with present theories. Qualitative agreement is found between theory and experiment and it is also found that it is possible to derive a "safe" value for growth for small scale self-focusing. The criteria derived from self-focusing considerations alter the systems considerations for maximum output and/or economy from those derived if self-focusing is not considered.

7230 Damage resistance of dielectric reflectors for picosecond pulses. Newnam, B.E. (Los Alamos Scientific Lab., NM). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 414, 39-47(1974).

A state-of-the-art survey has been conducted to determine the range of damage thresholds of electron-gun-produced dielectric reflectors irradiated by 30-ps laser pulses at 1.06 μm. Seven commercial coating companies, experienced in producing refractory-oxide coatings, supplied total reflectors of a specified TiO_2/SiO_2 design deposited on low-scatter glass substrates provided by LASL. Optional reflectors of ZrO_2/SiO_2 were also evaluated. Single-shot thresholds were determined by laser-induced scatter and photoelectric detection of spark radiation. Thresholds of TiO_2/SiO_2 reflectors ranged from 1 to 4 J/cm^2; those for ZrO_2/SiO_2 reflectors ranged from 0.5 to 2 J/cm^2. Reflectors which exhibited a large amount of diffuse, weak-signal scatter generally had low thresholds.

7231 Damage thresholds in ZnSe, A/R coated NaCl and micromachined mirrors by 10.6 μm multijoule, nanosecond pulses. Stark, E.E. Jr.; Reichelt, W.H. (Los Alamos Scientific Lab., NM). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 414, 53-58(1974).

Multijoule, nanosecond pulses at 10.6 μm were used to determine the damage thresholds of uncoated and antireflection (A/R) coated ZnSe, A/R coated NaCl and micromachined mirrors. The ZnSe results indicate that the A/R coatings have a higher damage threshold than the bulk material. Antireflection coatings on NaCl were found to have a damage threshold slightly lower than uncoated NaCl. Damage thresholds for micromachined copper and gold are greater than 4 joules/cm^2.

7232 Periodic breakup of optical beams due to self-focusing. Campillo, A.J.; Shapiro, S.L.; Suydam, B.R. (Los Alamos Scientific Lab., NM). *Appl. Phys. Lett.;* **23**: No. 11, 628-630(1 Dec 1973).

Transverse spatial periodic breakup of an optical beam due to self-focusing has been experimentally observed. Each focal spot evolves from a zone with well-defined dimension. The formation from these zones is consistent with an instability theory. Calculated and experimentally observed zone dimensions and powers are in good quantitative agreement.

7233 Short-pulse multiline and multiband energy extraction in high-pressure CO_2-laser amplifiers. Feldman, B.J. (Los Alamos Scientific Lab., NM). *IEEE J. Quant. Electron.;* **QE-9**: No. 11, 1070-1078(Nov 1973).

The ability of a nanosecond or shorter CO_2-laser pulse consisting of a single vibrational—rotational transition to extract energy from an atmospheric-pressure CO_2 amplifier is limited owing to the finite rotational thermalization time in CO_2 and the larger number of rotational states which share the stored energy. Theoretical studies are reported which indicate that utilizing an incident pulse consisting of several vibrational—rotational lines within the 10.6-μ band substantial improvements can be obtained over single-line extraction. Even more dramatic improvements are possible if the pulse contains vibrational—rotational transitions at both the 10.6- and 9.6-μ bands. Quantitative energy-extraction results are presented for an input Gaussian pulse consisting of 1—5 10.6-μ transitions, and for a pulse containing one line at 9.6 μ and one at 10.6 μ, traversing a 1-m amplifier, for a wide range of input energies, pulsewidths, and gas pressures. Possibilities of using multiband techniques for pulse shaping are also discussed.

7234 Rotational relaxation effects in short-pulse CO_2 amplifiers. Schappert, G.T. (Los Alamos Scientific Lab., NM). *Appl. Phys. Lett.;* **23**: No. 6, 319-321(15 Sep 1973).

On the basis of a rate equation model, it is shown that the time constant for short-pulse energy extraction from all rotational levels in a CO_2 amplifier on a single P(J) or R(J) transition is larger than the rotational relaxation time by about 1/kappa(J,T), where kappa(J,T) is the partition fraction of the transition levels at the temperature T.

7235 Studies of intrinsic optical breakdown. Fradin, D.W. (Harvard Univ., Cambridge, MA); Bass, M. *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 387, 225-238(1973).

Previous work demonstrated that intrinsic optical damage is caused by electron avalanche breakdown. A number of recent studies of intrinsic damage have reinforced the original identification of the damage process and have probed various characteristics of avalanche breakdown. By using a ruby laser to induce damage in the alkali halides, frequency dispersion in the relative breakdown fields has been observed. This dispersion, which was not apparent at 1.06 μm, provides insight into the development of the avalanche. A mode-locked Nd:YAG laser with output pulses of 300 to 15 ps duration was used to induce damage in NaCl, and the results were compared to Q-switched studies. It was found that the rms breakdown field increased by almost an order of magnitude to over 10^7 volts/cm as the pulse duration was reduced from 10 ns to 15 ps. This result agrees at least qualitatively with published dc breakdown measurements. A statistical character to bulk optical damage was observed in a number of materials including sapphire and fused quartz and found to be indistinguishable from statistics observed in surface damage. This observation and measurements of the ratio of surface to bulk breakdown fields show that the intrinsic mechanisms for surface and bulk breakdown are identical. Finally, the effect of crystalline disorder on the breakdown strength of solids was studied by measuring the intrinsic damage fields for a polycrystal, an alloy, and an amorphous insulator and comparing the results to the damage fields for the respective single crystals.

7236 Electron-beam-controlled electrical discharge as a method of pumping large volumes of CO_2 laser media at high pressure. Fenstermacher, C.A.; Nutter, M.J.; Leland, W.T.; Boyer, K. (Los Alamos Scientific Lab., NM). *Appl. Phys. Lett.;* **20**: No. 2, 56-60(15 Jan 1972).

An electron-beam-controlled discharge has been used to pump a variety of CO_2 laser gas mixtures at atmospheric pressure in substantial volumes. Electrical and laser properties of the pumped medium have been measured. Small-signal-gain coefficients up to 0.045 cm^{-1} were achieved at field strengths of 3 kV/cm.

7237 FM and AM mode locking of the homogeneous laser. Part I. Theory. Kuizenga, D.J.; Siegman, A.E. (Stanford Univ., CA). *IEEE J. Quant. Electron.;* **QE-6**: No. 11, 694-708(Nov 1970).

A new general analysis for mode-locked operation of a homogeneously broadened laser with either internal phase (FM) or amplitude (AM) modulation is presented. In the analysis, a complex

Gaussian pulse is followed through one pass around the laser cavity. Approximations are made to the line shape and modulation characteristics to keep the pulse Gaussian. After one round trip, a self-consistent solution is required. This yields simple analytic expressions for the pulse length, frequency chirp, and bandwidth of the mode-locked pulses. The analysis is further extended to include effects of detuning of the modulator, in which case analytical expressions are obtained for the phase shift of the pulse within the modulation cycle, the shift of the pulse spectrum off line center, the change in pulse length, and the change in power output. Numerical results for a typical Nd : YAG laser are given. In the case of the FM mode-locked laser it is found that there is a frequency chirp on the pulse and that this causes pulse compression and stretching when the modulator is detuned. Etalon effects and dispersion effects are also considered.

7238 FM and AM mode locking of the homogeneous laser. Part II. Experimental results in a Nd:YAG laser with internal FM modulation. Kuizenga, D.J.; Siegman, A.E. (Stanford Univ. CA). *IEEE J. Quant, Electron.;* **QE-6**: No. 11, 709-715(Nov 1970).

In Part I of this paper, a theoretical analysis of the mode-locked homogeneous laser was given. This part presents experimental results for the Nd : YAG laser with internal phase modulation. $LiNbO_2$ was used as the modulator crystal, and a method to measure the single-pass phase retardation of the modulator accurately at 1.06 μ is described in detail. The pulsewidth and spectral width of the mode-locked laser were measured as a function of depth of modulation, and good agreement with theory was obtained. Etalon effects in the laser were observed, and the results agreed very well with the theory. Mode-locked spectral bandwidths of up to 16 GHz, implying mode-locked pulses as short as 40 ps, were obtained.

7239 Picosecond laser pulses. DeMaria, A.J.; Glenn, W.H. Jr.; Brienza, M.J.; Mack, M.E. (United Aircraft Research Labs., East Hartford, CT). *Proc. IEEE [8]Inst. Electr. Electron. Eng.[9];* **57**: No. 1, 2-25(Jan 1969).

The broad bandwidth and long storage lifetimes of Nd^{3+}: glass and ruby lasers have made possible the generation of picosecond laser pulses having peak powers in excess of one gigawatt and repetition rates in the microwave range. The numerous application areas of these pulses include research in nonlinear optics, transient response of atomic and molecular systems, optically generated plasmas, spectroscopy, ranging, optical information processing, and high-speed photography. This paper reviews several experimental techniques for generating, measuring, and utilizing these ultrashort laser pulses.

HEAT TRANSFER AND FLUID FLOW

REFER ALSO TO CITATION(S) 5787, 5788, 6542, 6592, 6593, 6597, 6756, 6771, 6796, 7255

7240 (CONF-761039—(Summ.)) **Two-phase flow and heat transfer symposium-workshop. Workshop reports.** (National Science Foundation, Washington, D.C. (USA); Miami Univ., Coral Gables, Fla. (USA). Clean Energy Research Inst.). 1976. 20p. Publishing Corp., Washington, DC.

From Two-phase flow and heat transfer symposium; Fort Lauderdale, Florida, United States of America (USA) (18 Oct 1976).

Summaries of the activities of five workshops held during the Oct. 18-20, 1976 symposium of two-phase flow and heat transfer and the recommendations of each group for future studies are presented. The five groups discussed: LWR-related nuclear safety aspects of two-phase flow; two-phase flow instability; mathematical modeling of two-phase flow; measurement techniques; and two-phase flow applications. (LCL)

7241 (COO—4155-2) **Interfacial stability with mass and heat transfer.** Hsieh, D.Y. (Brown Univ., Providence, R.I. (USA). Div. of Applied Mathematics). Jul 1977. Contract EY-77-S-02-4155. 20p. Dep. NTIS, PC A02/MF A01.

A simplified formulation is presented to deal with interfacial stability problems with mass and heat transfer. For Rayleigh-Taylor stability problems of a liquid-vapor system, it was found that the effect of mass and heat transfer tends to enhance the stability of the system when the vapor is hotter than the liquid, although the classical stability criterion is still valid. For Kelvin-Holmholtz stability problems, however, the classical stability criterion was found to be modified substantially due to the effect of mass and heat transfer.

7242 (K—1897) **Pressure drop and heat transfer characteristics of refrigerant-114 boiling in a horizontal tube.** Brock, W.R. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 332p. Dep. NTIS, PC A14/MF A01.

The two-phase pressure drop and heat transfer characteristics of R-114 flowing in a horizontal tube were studied. Flow regime studies were also performed as a part of this effort. Boiling temperature was varied from 100 to 250°F and mass flux was varied from 0.12 to 3.4 x 10^6 lbm/hr-sq ft. No single method for predicting flow regime was found to be accurate over the range of conditions studied. The method proposed by Knowles was the best available for determining the stratified and intermittent flow regimes, and the analysis of Quandt was the most reliable in predicting the annular flow regime. Four correlations gave promising results when compared to the experimental, frictional pressure drop data. The Martinelli-Nelson correlation agreed fairly well with all of the data obtained. The degree of data scatter was, however, fairly large. Two correlations proposed by Chisolm which include a mass flux effect gave slightly better results when compared with the experimental data. The correlation proposed by Baroczy, generally, gave good results when applied to the medium-to-high mass flux data. The experimental heat transfer coefficient data could not be predicted accurately by a single correlation. The original Chen correlation offered the best agreement of any correlation considered. The degree of agreement between experimental data and correlation was improved by applying the original Chen correlation to the low mass flux data and Jallouk's modification to the remaining data.

7243 (K/CSD/TM—11) **HEATPLOT: a temperature distribution plotting program for heating.** Elrod, D.C.; Turner, W.D. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). Jul 1977. Contract W-7405-ENG-26. 78p. Dep. NTIS, PC A05/MF A01.

HEATPLOT is a temperature distribution plotting program that may be used with HEATING5, a generalized heat conduction code. HEATPLOT is capable of drawing temperature contours (isotherms), temperature-time profiles, and temperature-distance profiles from the current HEATING5 temperature distribution or from temperature changes relative to the initial temperature distribution. Contour plots may be made for two- or three-dimensional models. Temperature-time profiles and temperature-distance profiles may be made for one-, two-, and three-dimensional models. HEATPLOT is an IBM 360/370 computer code which uses the DISSPLA plotting package. Plots may be created on the CALCOMP pen-and-ink, and CALCOMP cathode ray tube (CRT), or the EAI pen-and-ink plotters. Printer plots may be produced or a compressed data set that may be routed to any of the available plotters may be made.

7244 (LA—6912-MS) **Heat transfer and flow friction in fine porous media.** Steyert, W.A. (Los Alamos Scientific Lab., N.Mex. (USA)). Sep 1977. Contract W-7405-ENG-36. 13p. Dep. NTIS, PC A02/MF A01.

Fluid-flow friction factors and heat-transfer coefficients are reported for fine screens (40, 80, and 100 mesh) and for packed fine copper spheres (70 μm). The fluids used are nitrogen and helium gas and water. The observed values do not deviate greatly from the values determined by scaling previous measurements taken from much coarser structures.

7245 (SAND—77-1261) **Entry flow in straight and curved channels with the slender channel approximations.** Blottner, F.G. (Sandia Labs., Albuquerque, N.Mex. (USA)). Aug 1977. Contract EY-76-C-04-0789. 58p. Dep. NTIS, PC A04/MF A01.

The slender channel equations for laminar flow are solved in the entrance region of curved channels of variable height. The singularities at the entrance are removed with coordinate transformations which stretch the boundary layer and shrink the core flow. Initial conditions at the entrance are obtained from the governing equations with only the streamwise velocity specified. A modified box scheme is used to develop a finite-difference method which allows the derivatives of the dependent variables across the channel to be discontinuous at the interface between the boundary layer and core flow. Numerical results are presented for several channel geometries and entry conditions.

7246 Calculational methods for performance of heat exchangers enhanced with fluidized bed. Suo, M. *Lett. Heat Mass Transfer;* **3**: 555-564(1976).

The characteristics of fluidized beds are such that the analytical procedures for calculating the performance of conventional heat exchangers are not applicable to heat exchangers using fluidized bed heat transfer enhancement. Analytical procedures applicable to two different design approaches to heat exchangers utilizing fluidized bed heat transfer enhancement are developed, and the results are presented in graphical form.

7247 (ORNL-tr—4406) **Review of boiling heat transfer to helium (Part 1).** Sato, S.; Ogata, H. Translated from *Cryog. Eng. [8]Tokyo[9];* **12**: No. 1, 2-18(1976). 33p. Dep. NTIS, PC A03/MF A01.

Recent advantages in the field of boiling heat transfer under natural convection (pool boiling and boiling in confined channels) for helium-I are reviewed. The published experimental data are compared with some of the proposed correlations. It would appear that the data of nucleate boiling are widely scattered, whereas the film boiling regime can be predicted successfully. The studies on channel boiling mostly deal with critical heat flux to establish its empirical correlation.

MATERIALS TESTING

REFER ALSO TO CITATION(S) 6689, 6690, 6691, 6692

7248 (MHSMP—77-5F) **Photographic instrumentation for the skid test. Period covered: October—December 1976.** Van Velkinburgh, J.H. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1977. Contract EY-76-C-04-0487. 7p. Dep. NTIS, PC A02/MF A01.

Fastax camera film records were obtained on each skid test. The film records are used to: (1) provide an indication of the reaction level obtained, (2) provide an indication of whether the skid test sample (billet) impacted the target properly, (3) provide the final velocity of rotation of the billet after the impact, and (4) provide the coefficient of restitution of the billet after the impact. Items 1 and 2 provide only qualitative data. The reliability of the data obtained in items 3 and 4 is directly a function of the quality of the Fastax film record. Procedures defined to improve the Fastax camera film records are outlined.

7249 (SAND—77-0652) **Sandia Laboratories technical capabilities: quality assurance.** (Sandia Labs., Albuquerque, N.Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Aug 1977. Contract EY-76-C-04-0789. 10p. Dep. NTIS, PC A02/MF A01.

A brief description and examples of quality assurance activities at the Sandia Laboratories are given. (TFD)

SAFETY ENGINEERING

7250 (SLAC-PUB—822) **Some engineering objections to using reinforcing steel as grounding electrodes.** Harding, G.; Harris, C.A. (Stanford Linear Accelerator Center, Calif. (USA)). 1970. 4p. (CONF-701090—1). Dep. NTIS, PC A02/MF A01.

From IGA group annual meeting (G-IGA); Chicago, Illinois, USA (5 Oct 1970).

A summary is given of a literature search on the corrosion of reinforcing steel and examines the ways that electrolytic action can degrade the steel. It also outlines engineering methods for mitigating such corrosion.

VACUUM ENGINEERING

7251 (BNL—23195) **Nitrogen pressure in a vacuum system.** Edwards, D. Jr. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 12p. (CONF-771110—3). Dep. NTIS, PC A02/MF A01.

From 24. national vacuum symposium of the American Vacuum Society; Boston, Massachusetts, USA (8 Nov 1977).

Since the N_2 outgassing rate from walls of a vacuum system is generally recognized to be very small, the presence of a N_2 pressure in the system is a useful indication of the presence of real leaks to the atmosphere. A technique of thermal desorption mass spectrometry is introduced which allows the N_2 pressure in the background gas of a baked system to be separated from a CH_4 background to a minimum level of N_2 detectability of approximately 1 percent of the CO background pressure. In typical baked systems (of which an example is given), it is possible to readily determine the sum of all real N_2 leaks to atmosphere at a level of approximately 10^{-11} Torr liter/s. This feature makes the technique ideally suited to large complex systems since the leak rate can be evaluated before detailed leak finding procedures are initiated.

ELECTRONIC CIRCUITS AND DEVICES

REFER ALSO TO CITATION(S) 7313, 7317

7252 (SAND—76-9149) **Process controls to increase the effectiveness of beam lead devices in high-rel applications.** McDowell, J.; Bushmire, D. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 4p. (CONF-770424—1). Dep. NTIS, PC A02/MF A01.

From International reliability physics symposium; Las Vegas, Nevada, United States of America (USA) (12 Apr 1977).

Four years of experience in beam lead device technology is reported. Specific problems encountered in the use of these devices in high-rel military systems are discussed. Some of the technology problems have only recently been recognized by users and have received little if any publicity. Process controls recommended have resulted in fewer beam lead device process problems, improved yields in next assembly applications and reduced incidence of latent device failures.

7253 (SAND—76-9149C) **Process controls to increase the effectiveness of beam lead devices in high-rel applications.** McDowell, J.; Bushmire, D. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 12p. (CONF-770907—1). Dep. NTIS, PC A02/MF A01.

From International solvent extraction conference; Toronto, Canada (9 Sep 1977).

Four years of experience in beam lead device technology is reported. Specific problems encountered in the use of these devices in high-rel military systems are discussed. Some of the technology problems have only recently been recognized by users and have received little, if any, publicity. Process controls recommended have resulted in fewer beam lead device process problems, improved yields in next assembly applications, and reduced incidence of latent device failures.

7254 (SAND—77-0881C) **Broad spectrum applications resources network.** (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 28p. (CONF-770536—1). Dep. NTIS, PC A03/MF A01.

From APPLICON user's group meeting; Framingham, Massachusetts, United States of America (USA) (16 May 1977).

Activities in computer-aided design of electronic circuits at Sandia Laboratories are described. (TFD)

SOLID WASTE PROCESSING PLANTS AND EQUIPMENT

REFER ALSO TO CITATION(S) 6905

COMBUSTION SYSTEMS

REFER ALSO TO CITATION(S) 5878, 5879, 5881, 6526, 7010, 7050

7255 (NYU/DAS—77-17) **Heat transfer characteristics in a fluidized bed packed with heat exchangers.** Zakkay, V.; Miller, G.; Brentan, A. (New York Univ., N.Y. (USA). Div. of Applied Science). Aug 1977. Contract EX-76-C-01-2256. 46p. (CONF-771015—2). Dep. NTIS, PC A03/MF A01.

From Fall meeting of the Western States Section of the Combustion Institute; Palo Alto, California, USA (17 Oct 1977).

Under a contract to investigate the interrelationships between temperature distribution, fluid flow, boiler size and heat exchanger design in a fossil-fuel fired fluidized bed combustor a 1-ft and a 3-ft dia bed with attendant instrumentation were designed, built, and tested. Heat transfer results obtained in the 1-ft dia facility are presented. The results indicate that by a proper distribution of the fluidizing gas at the grid, the steam generating surface of the boiler can be reduced significantly. These results thus imply that for a given boiler configuration, one can obtain significantly more steam generation by changing the injection path at the fluidizing grid. In addition, the experimental results obtained utilizing the 1-ft-dia bed have shown that vertical tube arrangements are more efficient than horizontal tube arrangements in the low velocity range. The ongoing investigation is performed by utilizing an external heat source (a gas burner). This approach is justified (as a first approach) since coal combustion in a fluidized bed is very rapid and most of the combustion occurs near the injection point. The investigation has concentrated on studying the fluid mechanics in fluidized beds packed with heat exchangers, developing proper instrumentation for making detailed measurements in the bed, constructing versatile units which can be easily modified, and determining the effects of scale. A large data base has been derived from the 1-ft unit under a wide variety of conditions. Transient measurements taken in the bed have explained the more efficient performance of pressurized vessels.

7256 **Optimizing of combustion processes in metallurgical and non-metallurgical kilns by hydrocarbons and liquid proportioning facilities.** Casties, H. *Aufbereit.-Tech.;* **18**: No. 1, 34-36(Jan 1977). (In German with English abstract).

For a liquid-gas (butane) firing system in a double-shaft lime kiln, the proportioning pump meters the fuel to 19 firing points in each shaft. For supplying butane fuel oil to a blast furnace, metering and delivering of liquid gas to the different points of injection in the tuyeres of the blast furnace is done over the proportioning system. The proportioning system is equipped with as many pump heads as there are tuyeres at the furnace. The fuel-oil supply circuit is a closed system reaching from the fuel-oil tank to the point of injection. Before entering the injection lances, the fuel-oil flow is united and intensively mixed with the liquid flow originating from the butane supply circuit.

7257 **Study of liquid fuel combustion in tunnel burners.** Goldman, Y.; Manheimer-Timnat, Y. (Technion--Isr Inst of Technol, Haifa). *Isr. J. Technol.;* **14**: No. 4-5, 179-186(1976).

The influence of three different tunnels on the performance of burners in a model industrial furnace is investigated experimentally. The best combustion quality is achieved by the smallest tunnel, which produces the most favorable recirculation pattern, as corroborated by model experiments. 9 refs.

UNDERGROUND ENGINEERING

7258 (CONF-7609125—, pp 11p, Paper 20) **Significance of waterproofing in mines for the prevention of accidents in the working.** Neuhoefer, K.E. (Stutz GmbH, Bochum, Ger.). 1976. (In German).

From International symposium on water resources policy and the winning of fossil energy carriers; Duesseldorf, German, Federal Republic of (F.R. Germany) (7 Sep 1976).

In Proceedings of the international symposium on fossil fuel production and water resources.

The necessity for waterproofing mines is briefly summarized. The use of STUPUR waterproofing, a high-grade special concrete, for waterproofing mines is illustrated. (JSR)

7259 (Y/OWI/SUB—77/22303/P1) **Structural behavior of progressively mined solution cavities in salt.** Fossum, A.F. (RE/SPEC, Inc., Rapid City, S.Dak. (USA)). Mar 1977. Contract W-7405-ENG-26. 23p. Dep. NTIS, PC A02/MF A01.

The stress field and the time dependent deformation around a solution cavity in rock salt are shown to be sensitive to the details of the excavation process and to the prevailing tectonic stress field. An analysis procedure is developing whereby an incremental excavation procedure and a creep routine are incorporated simultaneously into an axisymmetric finite element code.

7260 (UCRL-Trans—11262) **Possibility of modeling the fracture zones in a rock-salt mass which result from powerful camouflet explosions.** Borisov, A.A.; Leonov, Ye.A.; Tolstunov, S.A. Translated from *Izv. Vyssh. Uchebn. Zaved., Gorn. Zh.;* No. 12, 81-84(1974). 10p. Dep. NTIS, PC A02/MF A01.

The development of a mathematical model for describing the mechanical effects of large contained explosions in salt deposits is described, and results obtained for cavity radius and fracture zone radius calculated with this model are compared with measurements made in US and USSR experiments with contained nuclear explosions in salt deposits. The results showed good agreement, and indicated the accuracy of the assumptions made for the model and its capability for predicting the effects of powerful explosions in salt deposits. (LCL)

MARINE ENGINEERING

REFER ALSO TO CITATION(S) 6259

7261 **Mobile offshore platform.** Hellerman, L.W.; Hollyer, R.S. (to Marine Engineering Systems, Inc.). US Patent 4,040,265. 9 Aug 1977. Filed date 6 Feb 1976. 16p.

A mobile offshore platform in which a support structure receives interchangeable barges thereon for carrying out the different functions required in producing an offshore hydrocarbon reservoir. The mobile offshore platform includes a plurality of support legs extending into the water down to the ocean floor. Jacking mechanisms engage each support leg to raise and lower a negatively buoyant, open network platform structure relative to the surface of the water. A barge having a process plant installed on board is docked in position on the platform structure. A heave absorber disposed above the surface level of the platform structure engages the bottom of the barge to dampen vertical motion thereof. The platform structure and the barge are raised above the water to the required height, where-upon the platform structure is secured to the legs and the jacks may be removed for use on another platform. The mobile offshore platform is ideally suited for a mobile offshore processing plant which can be installed at the offshore well site to process hydrocarbons, particularly natural gas, into products which can be easily transported. Other uses include offshore exploration drilling, production drilling, production, well servicing and work over, and general construction uses.

POLLUTION CONTROL EQUIPMENT

7262 **Fine particle control technology: conventional and novel devices.** Drehmel, D.C. *J. Air Pollut. Control Assoc.;* 27: No. 2, 138-140(Feb 1977).

This paper summarizes the results of U.S. Environmental Protection Agency measurements of the efficiency of fine particle collection devices. If the ash resistivity is approximately 100 gigaohm-cm, 90 percent efficiency can be achieved in all particle size ranges by an electrostatic precipitator. Where space considerations allow, fabric filtration provides an efficiency greater than 95 percent for all size ranges. New techniques may be applicable in special circumstances: for example where waste heat is available, high removal efficiencies at low additional energy consumption are possible.

PARTICLE ACCELERATORS

DESIGN, DEVELOPMENT, AND OPERATION

REFER ALSO TO CITATION(S) 7288, 7438

7263 (BNL—22874) **North-American MP Tandem accelerators.** Wegner, H.E.; Thieberger, P. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 31p. (CONF-770527—4). Dep. NTIS, PC A03/MF A01.

From 2. international conference on electrostatic accelerator technology; Strasbourg, France (24 May 1977).

There are six North-American MP Tandem accelerators: Yale; Minnesota; Chalk River; Rochester; and two at Brookhaven. The current status and operating characteristics of these six tandem accelerators are discussed. Upgrade and special improvements of the different machines is reviewed and new developments since the last Electrostatic Conference are discussed in detail. The overall operating characteristics of the different machines during the last year of operation are compared.

7264 (CONF-770527—2) **Holifield Heavy-Ion Research Facility at Oak Ridge.** Jones, C.M. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 25p. Dep. NTIS, PC A02/MF A01.

From 2. international conference on electrostatic accelerator technology; Strasbourg, France (24 May 1977).

A new heavy-ion accelerator facility is now under construction at the Oak Ridge National Laboratory. A brief description of the scope and schedule of this project is given, and the new large tandem accelerator, which will be a major element of the facility is discussed in some detail. Several studies which have been made or are in progress in Oak Ridge in preparation for operation of the tandem accelerator are briefly described.

7265 (CONF-770709—1) **Energy Doubler/Saver at Fermilab: a status report.** Fowler, W.B. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 1977. Contract EY-76-C-02-3000. 17p. Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

Guided, as in the past, by close attention to the developing theoretical and experimental evidence for new phenomena (for example, the discoveries of weak neutral currents, charm, J/psi and the Upsilon) Fermilab has devoted considerable effort to pushing on to higher energies. This seems particularly appropriate since other phenomena is suggested, such as intermediate vector bosons (W^+ and Z^0) etc. The TeV Project at Fermilab pursues both increases in the available energy via doubling the energy of the present accelerator as a fixed target, high intensity proton synchrotron and via colliding beams. These ways are complementary to one another. High energy physics with fixed targets cannot match the energy available in the center of mass system that can be achieved in colliding beams, whereas physics with colliding beams cannot match the intensities or the variety of bombarding particles that can be achieved with fixed targets. Some of the aspects of each technique are given.

7266 (CONF-770709—5) **Polarized proton acceleration at the Zero Gradient Synchrotron.** Martin, R.L. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 8p. Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

The Zero Gradient Synchrotron (ZGS) has accelerated polarized protons for four years. During that time, there have been continued improvements in intensity, reliability, flexibility, and understanding. Most recently, the loss of 15 to 20 percent of the polarization between 6 and 12 GeV/c was eliminated. This loss was determined to be due to imperfection resonances, whose correction requires precise adjustment of the midplane at 19 times during the acceleration cycle. This process is briefly discussed.

7267 (CONF-770709—9) **Fermilab accelerator: status and development plans.** (Fermi National Accelerator Lab., Batavia, Ill.

(USA)). 1977. Contract EY-76-C-02-3000. 12p. Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

The Fermilab accelerator has been in operation since 1972. The first operation was at 200 GeV, although the energy was soon raised to a nominal value of 300 GeV. Since July 1975, 400 GeV has been the normal energy. The machine was operated at 500 GeV in May 1976. The accelerator system is composed of a 750-kV Cockcroft—Walton, a 200-MeV linac, an 8-GeV to 15-Hertz booster, and a 500-GeV main ring. The linac injects one pulse into the booster and the booster injects the 8-GeV pulse into the main ring, each using single-turn injection. This process is repeated 13 times to fill the main ring circumference before accelertion begins. A switchyard system splits the extracted beam to 6 different external targets. There is one internal target area with 3 possible targets. The linac can also deliver a 66-MeV beam to a neutron cancer therapy facility and a 200-MeV proton beam to a radiography experiment. A project is being initiated to study electron cooling of 200-MeV protons. Upon successful cooling of protons, studies will begin on the cooling and accumulation of antiprotons. The antiprotons would be injected into the main ring and simultaneously accelerated with protons to produce antiproton-proton colliding beams. Work is in progress at Fermilab on the construction of a 1000-GeV superconducting Energy Doubler/Saver to be installed in the present main-ring tunnel. With both the main ring and energy doubler in the same tunnel, it is obvious proton—proton colliding beams will be possible. The complete system of 1000-GeV fixed-target physics, 250 GeV (main ring) x 1000 GeV (doubler) proton—proton physics and 1000 GeV x 1000 GeV proton—antiproton physics in the doubler has been named the Tevatron.

7268 (FERMILAB—77/6) **Fermi National Accelerator Laboratory monthly report, June 1977.** Cole, F.T.; Donaldson, R. (eds.). (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 1977. Contract EY-76-C-02-3000. 28p. Dep. NTIS, PC A03/MF A01.

Contents include: (1) The Fermilab TeV Program; (2) notes and announcements; (3) research activities during May 1977; (4) facility utilization summary for May 1977; and (5) proposals received during May and June 1977. For the Fermilab TeV Program, a discussion is given of the superconducting ring, colliding beams, and Tevatron construction.

7269 (LA—6819-PR) **Medium-energy physics program. Progress report, November 1, 1976—January 31, 1977.** Dunn, E. (comp.). (Los Alamos Scientific Lab., N.Mex. (USA)). Jun 1977. Contract W-7405-ENG-36. 127p. Dep. NTIS, PC A07/MF A01.

Operations and research programs at the LAMPF Linac are reported for the period from November 1, 1976 through January 31, 1977. The contents include: (1) a summary and a list of recent publications; (2) engineering support; (3) accelerator support; (4) accelerator systems development; (5) injector systems; (6) electronic instrumentation and computer systems; (7) accelerator operations; (8) experimental areas; (9) beam line development; (10) large-spectrometer systems; (11) research; (12) nuclear chemistry; (13) practical applications of LAMPF; (14) the PIGMI program (Pion Generator for Medical Irradiations); and (15) management. (PMA)

7270 (LBL—6425) **Relativistic heavy ion accelerators.** Grunder, H.A.; Leemann, C.W.; Selph, F.B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1977. Contract W-7405-ENG-48. 34p. (CONF-770709—14). Dep. NTIS, PC A03/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

There is a growing interest in the scientific community in the use of accelerators to produce relativistic heavy ion beams for a number of purposes. It now appears that relativistic heavy ion collisions may provide an opportunity to study nuclear matter far from equilibrium density, pressure, and temperature. Heavy ion beams can also be used as simulated cosmic rays for astrophysical research and in planning space probes. At present the only relativistic heavy ion accelerator is the Belvalac at LBL. It has been devoted to this use since 1974. The operating experience and capabilities of this machine are reviewed as well as present and planned experimental programs. Designs of accelerators for relativistic heavy ions are discussed. A number of considerations will cause a machine to differ from a proton machine if optimally designed for heavy ion acceleration. A possible set of parameters is presented for an accelerator to produce intense beams of mass 10 to 200 ions, at energies up to 10 GeV/amu.

BEAM DYNAMICS, FIELD CALCULATIONS, AND ION OPTICS

7271 (BNL—23044) **Beam size blow-up and current loss in the Fermilab main ring during storage.** Guignard, G.; Month, M. (European Organization for Nuclear Research, Geneva (Switzerland); Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 12p. Dep. NTIS, PC A02/MF A01.

Observations at Fermilab during the storage mode of operation show characteristic forms of transverse beam size growth and current loss with time. There are three obvious mechanisms which can produce such blowup. The gas pressure is a source for immediate beam loss by direct nuclear scattering. Protons can also multiple Coulomb scatter off the orbiting electrons of the gas atoms causing the transverse beam size to increase with time, t. This effect is therefore also proportional to the gas pressure. A third mechanism not related to the gas pressure is beam growth due to multiple crossing of betatron resonances arising from the synchrotron oscillations of the stored bunches. This simulates a random walk and causes the transverse beam size to grow with $\sqrt{t}$. An attempt is made to describe the observations with direct nuclear scattering, multiple coulomb scattering and multiple resonance crossing. In addition to the loss rate from direct nuclear scattering, the presence of betatron resonances also contribute to particle loss. In fact this latter effect becomes dominant after the beam size reaches a critical value. This critical size is referred to as the resonance aperture. It is the size at which "fast" resonance crossing is no longer valid. The stopband width becomes so large (due both to emittance growth as well as the increase in magnetic field distortions) that particles are locked into the resonance and are extracted to the physical aperture. The model is described in a phenomenological way, and the coefficients involved are estimated. Theoretical curves for transverse beam growth and loss rate are plotted and compared with some measured values. Finally, some general comments are given.

7272 (BNL—23045) **Bunch lengthening in the Fermilab main ring during storage.** Guignard, G.; Month, M. (European Organization for Nuclear Research, Geneva (Switzerland); Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 8p. Dep. NTIS, PC A02/MF A01.

There are two known current dependent effects which can increase the length of stored bunched beams: (1) a reduction of the potential well of the applied rf focusing system; and (2) induced unstable oscillations of the bunches, which can stabilize at a longer length by the process of Landau damping. In the first case, the current distribution in the bunches, interacting with induced electromagnetic fields in the walls, leaves a wake field which acts back on the bunches. A new equilibrium bunch shape results, different from that due to the applied rf, and this new equilibrium bunch shape will slowly establish itself as the particles within the bunch move on their new trajectories. The second form of bunch instability is the single bunch type. These are characterized by high frequency (i.e. within bunch) oscillations in the microwave region and fast growth rates. The coherent effects are very difficult to observe and such instabilities tend to simulate an incoherent growth in the bunch. An attempt is made to describe the observation of bunch lengthening in the main ring in terms of both potential well distortion and induced microwave fields. It is found that the increase in bunch size is in qualitative agreement with an induced microwave instability if the wall (i.e. chamber discontinuities) couples to beam with a broad resistive impedance in the microwave region of the order of Z/n approximately 75 OMEGA (n is the mode number of the oscillation of frequency f = nf/sub rev/).

7273 (CONF-770527—1) **Resolving beam transport problems in electrostatic accelerators.** Larson, J.D. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 30p. Dep. NTIS, PC A03/MF A01.

From 2. international conference on electrostatic accelerator technology; Strasbourg, France (24 May 1977).

A review is given of problem areas in beam transmission which are frequently encountered during the design, operation and upgrading of electrostatic accelerators. Examples are provided of analytic procedures that clarify accelerator ion optics and lead to more effective beam transport. Suggestions are made for evaluating accelerator design with the goal of improved performance.

7274 (CONF-770709—10) **Computer simulation of bunch lengthening and widening in proton storage rings.** Ruggiero, A.G. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 1977. Contract EY-76-C-02-3000. 6p. Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

Beam bunch blow-ups have been observed in the ISR and recently in the main ring at Fermilab. In the latter case the bunch lengthening is too large, typically by a factor three, to be simply explained as due to a modification of the potential well in the

presence of inductive elements at the wall. Also the growth behavior is different from bunch to bunch in the same pulse. The lack of bunch-to-bunch correlation would then lead to speculate the existence of resonating items with very low figure of merit. At the same time plans have been worked out at Fermilab to get the main ring intersecting with the energy doubler, a superconducting ring presently under development, for p-p collision experiments with up to 1400 GeV in the center of mass. It would be crucial then to understand and to prevent the bunch blow-up that otherwise would limit the luminosity performance of the colliding beams. For this purpose, computer simulations of the motion of proton bunches in a machine like the Fermilab main ring or energy doubler were performed.

7275 (CONF-770709—12) **Effects limiting accelerated beam intensity in the largest proton synchrotron.** Teng, L.C. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 1977. Contract EY-76-C-02-3000. 13p. Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

The two major categories of beam-dynamical considerations in designing very large proton synchrotrons that bear direct relation to the ultimate beam intensity achievable are discussed. It is assumed that in all future multi-TeV proton synchrotrons, limitations of physical size and electric-power consumption will necessitate the use of superconducting magnets. The relatively large field errors encountered in these magnets demand a closer re-examination of single-particle dynamics. In addition, the extensively investigated self-field effects will be present and will be equally important at beam currents similar to those in smaller accelerators. A third major consideration that may also limit the attainable intensity is the effect of stray beam striking superconducting magnets and causing them to quench.

AUXILIARIES AND COMPONENTS

REFER ALSO TO CITATION(S) 7763

7276 (BNL—23211) **Stability of high field superconducting dipole magnets.** Allinger, J.; Danby, G.; Foelsche, H.; Jackson, J.; Prodell, A.; Stevens, A. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 5p. (CONF-770842—11). Dep. NTIS, PC A02/MF A01.

From 6. international conference on magnet technology; Bratislava, Czechoslovakia (29 Aug 1977).

Superconducting dipole magnets of the window-frame type were constructed and operated successfully at Brookhaven National Laboratory. Examples of this type of magnet are the 6 T "Model T" magnet, and the 4 T 8° superconducting bending magnet. The latter magnet operated reliably since October 1973 as part of the proton beam transport to the north experimental area at the BNL AGS with intensities of typically 8 x 10^{12} protons at 28.5 GeV/c passing through the magnet in a curved trajectory with the proton beam center only 2.0 cm from the beam pipe at both ends and the middle of each of the two units comprising the magnet. The energy in the beam is approximately 40 kJ per 3 μsec pulse. Targets were inserted in the beam at locations 2 m and 5.6 m upstream of the first magnet unit to observe the effects of radiation heating. The 8° magnet demonstrated ultrastability, surviving 3 μsec thermal pulses delivering up to 1 kJ into the cold magnet at repetition periods as short as 1.3 sec.

7277 (LA-UR—77-1789) **Experience with the LAMPF mineral-insulated magnets.** Harvey, A. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 7p. (CONF-770842—3). MF A01.

From 6. international conference on magnet technology; Bratislava, Czechoslovakia (29 Aug 1977).

The LAMPF accelerator now produces 800 MeV protons at an average current of 225 μA, which is scheduled to be raised gradually to 1mA by 1979. The magnet coil insulation generally adopted to withstand the expected high radiation levels, particularly near the targets, uses compacted powered MgO (mineral-insulation). An amorphous, ceramic material, it is highly resistant to both high temperatures and radiation. Sixty-four mineral-insulated magnets have given generally satisfactory service at LAMPF since 1972; the problems experienced are described. In addition to provisions for replacing a faulty magnet remotely, if its induced radioactivity is too high for hands-on maintenance, the internal magnet arrangement is being altered to permit manipulator repair, since the components causing failure are usually a small part of the complete magnet value. Development of the cable system basic to this magnet technology has raised ratings, giving lower conductor resistance and higher water flow in hollow-conductor directly-cooled cables; and lower resistance and thinner insulation in solid-conductor, indirectly-cooled cables. Experimental cables 1½ X 2 inch cross-section (4 x 5 cm) were produced.

INJECTION AND EXTRACTION SYSTEMS

7278 (CONF-770607—4) **Pulsed power supply for injection bump magnets.** Praeg, W.F. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 9p. Dep. NTIS, PC A02/MF A01.

From Joint automatic control conference and IEEE Society on Control Systems; San Francisco, California, United States of America (USA) (22 Jun 1977).

A very precise and relatively inexpensive charging circuit for an energy storage capacitor bank feeds an efficient thyristor-controlled pulse-forming discharge circuit. These circuits, which generate magnet pulses of 300 joules at a rate of 30 per second, are analyzed.

EXPERIMENTAL FACILITIES AND EQUIPMENT

REFER ALSO TO CITATION(S) 7307

7279 (LA-UR—77-1545) **Accelerating and focusing structures for PIGMI.** Swenson, D.A.; Bush, E.D. Jr.; Holsinger, R.F.; Manca, J.J.; Saito, N.; Stovall, J.E. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 8p. (CONF-770709—13). Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

The National Cancer Institute is supporting a program of accelerator development at the Los Alamos Scientific Laboratory aimed at the extension of proton linac technologies to produce the most suitable Pion Generator for Medical Irradiations (PIGMI). An optimized design of a pion generator suitable for a radiotherapy program at a major medical center has been established, consisting of a 250-keV injector, followed by a 35-meter-long drift-tube linac that accelerates the proton beam to 150 MeV, and an 85-meter-long coupled-cavity linac that accelerates the beam to its final energy of 650 MeV, where the average beam current of 100 microamperes impinges on one or more targets producing abundant quantities of π^- mesons for radiotherapeutic applications. A number of extensions to proton linac technology are being pursued under the PIGMI program at LASL. A discussion is given of recent developments in three areas relevant to the acceleration and focusing of proton beams, namely, the alternating phase focused (APF) linac structure, the disk and washer linac structure, and small permanent magnet quadrupole lenses. The APF linac structure is being developed for the acceleration and focusing role from the injection energy of 250 keV to a few MeV, where a transition is made to a permanent magnet quadrupole focused linac structure. The disk and washer linac structure is under consideration for the high velocity portion of the design.

7280 (ORNL/TM—6028) **Scattering chamber for the Holifield Heavy Ion Research Facility.** Goodman, C.D.; Corum, J.E. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 15p. Dep. NTIS, PC A02/MF A01.

A conceptual design is presented for a 62-in.-diam. general purpose scattering chamber to be used for nuclear research with heavy ions. The detector rotation mechanism is based on large diameter (approx. 58 in.) peripherally driven rings. This leaves the central region open for detectors and other apparatus and permits the use of a perpendicular ring for rotating a detector out of the reaction plane. A precision target slide with provisions for removing the entire slide under vacuum is part of the design. Access and viewing ports on the dished top and in the reaction plane will be provided. Cryogenic pumping will be used to keep the vacuum free from hydrocarbon vapors, water vapor, and oxygen.

7281 (LA-tr—77-55) **Operating manual for the Hera magnet, Sections 1—3.** (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1977. Translation of a French report. 26p. Dep. NTIS, PC A03/MF A01.

Operating instructions and diagrams are given for a superconducting magnet used with an accelerator target assembly. Operations include: (1) using the Collins liquefier; (2) cooling the coils; and (3) cooling the He^4 part of the target. Diagrams are given of the cryostat, liquid nitrogen circuits, and the electronic control circuits. (PMA)

7282 (ORNL-tr—4431) **Studies on the stripping of heavy ions by carbon foil.** Frick, G.; Gehringer, C.; Heusch, B.; Ricaud, C. Wagner, P.; Baron, E. 1977. Translation by D. Crenshaw of CRN-PN—75-53. 88p. Dep. NTIS, PC A05/MF A01.

One of the research problems presented by GANIL, the planned, large, French national heavy ion accelerator, is the stripping of heavy ions with carbon foil. The first part of an experimental

study of this problem is reported. Definitions, according to GANIL standards, are given for the energy, intensity, and dispersion characteristics of the beam at the level of the stripper. A discussion is given of how the properties of the ion beam passing through a stripper are changed; the ions undergo angular diffusion and a fluctuating energy loss. Finally, the foil is destroyed by breaking or tearing. The results of experiments carried out at the Center for Nuclear Research and intended to illustrate the problems of angular diffusion and straggling are reported, and the results are compared with theoretical predictions. A bibliographic study is given of radiation damage, most particularly in the case of GANIL beams. The phenomenon of the foil thickening, which may be linked to irradiation, is discussed, and some exceptional experimental results are reported in the framework of radiation damage. Several experiments which would permit better discernment of this question are proposed.

STORAGE RINGS

7283 (BNL—22465) **Computer networks in future accelerator control systems.** Dimmler, D.G. (Brookhaven National Lab., Upton, N.Y. (USA)). Mar 1977. Contract EY-76-C-02-0016. 17p. Dep. NTIS, PC A02/MF A01.

Some findings of a study concerning a computer based control and monitoring system for the proposed ISABELLE Intersecting Storage Accelerator are presented. Requirements for development and implementation of such a system are discussed. An architecture is proposed where the system components are partitioned along functional lines. Implementation of some conceptually significant components is reviewed.

7284 (BNL—22927) **Design of a 400—400 GeV² version of ISABELLE.** (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 10p. (CONF-770709—7). Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

An extrapolation of the ISABELLE 200-200 GeV² proton—proton storage rings to higher energy was studied, and the conceptual design is presented for a 400-400 GeV² version. The basic storage ring structure was so modified that the circumference of the rings could be substantially increased without an increase of the transition energy. Because of the now well established microwave longitudinal bunched beam instability, this is essential in maintaining a viable longitudinal impedance limit for the overall structure. The principal parameters for the 400 GeV structure are given and compared with the basic 200 GeV design. Performance limitations, where they may differ from the 200 GeV design are indicated. Each 400 GeV ring uses superconducting magnets essentially identical to those employed in the 200 GeV design, but energized to 50 kG peak field. The justification for this is given together with other technical features differing from the basic design. It is concluded that for a cost increase of 40% over the basic p—p storage ring design, twice the center-of-mass energy could be provided for the ISABELLE proton—proton colliding beam facility.

7285 (BNL—22930) **ISABELLE: a 200 + 200 GeV colliding beam facility.** Courant, E.D. (Brookhaven National Lab., Upton, N.Y. (USA); State Univ. of New York, Stony Brook (USA)). 1977. Contract EY-76-C-02-0016. 8p. (CONF-770709—8). Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

Plans are under way for the construction of a pair of intersecting storage rings providing for colliding beams of protons of energy at least 200 GeV. The rings (circumference 2.62 km) will contain superconducting magnets constructed with braided Nb—Ti filamentary wire, with a peak field of 4.0 T corresponding to an energy of 200 GeV. A current of 10 A of protons will be injected at 29 GeV from the existing AGS accelerator at Brookhaven, using the energy stacking technique similar to that employed at the CERN ISR; subsequently the stored beam will be accelerated gradually in the storage rings. Six intersection areas will be provided for experiments. They are designed to provide flexibility in beam characteristics for different experiments. The maximum luminosity at full energy is expected to be 1.0×10^{33} $cm^{-2}s^{-1}$, at 29 GeV it will be approximately 10^{32} $cm^{-2}s^{-1}$. Recent work with prototype magnets indicates that fields of 5.0 T can be produced. This has led to an alternative design of somewhat larger rings (circumference 3.77 km) that should be capable of providing colliding beams at 400 + 400 GeV.

7286 (BNL—23142) **Superconducting magnets for high energy storage rings.** Sampson, W.B. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 6p. (CONF-770842—2). Dep. NTIS, PC A02/MF A01.

From 6. international conference on magnet technology; Bratislava, Czechoslovakia (29 Aug 1977).

Superconducting dipole and quadrupole magnets were developed for the proton-proton intersecting storage accelerator ISABELLE. Full size prototypes of both kinds of magnets were constructed and successfully tested. The coils are fabricated from a single layer of wide braided superconductor and employ a low temperature iron core. This method of construction leads to two significant performance advantages; little or no training, and the ability of the coil to absorb its total magnetic stored energy without damage. A high pressure (15 atm) helium gas system is used for cooling. Measurements of the random field errors are compared with the expected field distribution. Three magnets (two dipoles and one quadrupole) were assembled into a segment of the accelerator ring structure (half cell). The performance of this magnet array, which is coupled in series both electrically and cryogenically, is also summarized.

7287 (BNL—50672) **Novel method of charging an accumulator ring.** Maschke, A.W. (Brookhaven National Lab., Upton, N.Y. (USA)). 20 May 1977. Contract EY-76-C-02-0016. 8p. Dep. NTIS, PC A02/MF A01.

For high power fusion applications, a circular accelerator for heavy ions is not likely to be competitive with a linear accelerator. This is principally because one requires rather high accelerator efficiencies, and quite large average power. Efficiencies greater than or equal to 10 percent, and perhaps 30 and 50 MW of average beam power are needed. On the other hand, the linear accelerator can be built to satisfy these constraints, and in addition, it is ideally suited for multi-turn injection. A difficulty with multi-turn injection is that in typical application it is rather lossy. With care, and sufficient phase space dilution, one might hope to obtain greater than or equal to 90 percent injection efficiency, but even at these levels the large amount of beam power lost in the accumulator might have serious consequences for the machine operation. Therefore, it is desirable to be able to use "box car" stacking, which is essentially 100 percent without particle loss. A method of operating the linear accelerator so that the output beam is of suitable instantaneous current to permit box-car stacking with the linac output is proposed.

7288 (ERDA—77-71) **Report of the 1977 Subpanel on New Facilities of the High Energy Physics Advisory Panel to the Energy Research and Development Administration.** (Energy Research and Development Administration, Washington, D.C. (USA)). Jun 1977. 29p. Dep. NTIS, PC A03/MF A01.

A report is presented in which recent developments in particle physics are outlined, technical considerations of the proposed ISABELLE storage ring at Brookhaven National Laboratory are discussed, and recommendations and comments are given with respect to the funding of ISABELLE and two construction proposals submitted by the Fermilab: (1) the Energy Doubler/Saver (Tevatron); and (2) the Colliding Beams Experimental Facility. As a first priority, the authorization of the BNL proposal for the construction of ISABELLE is recommended. ISABELLE is to be a proton-proton colliding beam facility operating with a maximum energy of about 400 GeV per beam and a peak luminosity of 10^{33} cm^{-2} s^{-1}. Some effects of alternate funding constraints are delineated. (PMA)

7289 (LBL—6459) **Evolution of the amplitude distribution function for a beam subjected to stochastic cooling.** Laslett, L.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1977. Contract W-7405-ENG-48. 8p. (CONF-770709—3). Dep. NTIS, PC A02/MF A01.

From 10. international conference on high energy accelerators; Serpukhov, Union of Soviet Socialist Republics (USSR) (11 Jul 1977).

The suggestion of S. van der Meer for stochastic cooling or feedback damping of a circulating charged particle beam offers promise of increasing the luminosity of a storage ring and may be a particularly attractive technique if antiprotons are to be employed as one of the beams in such a device. The original report of van der Meer considered the repeated use of a kicker to suppress the transverse phase-space displacement of the centroid of a group of particles detected at a pick-up station situated up-stream, and the report estimated the expected rate of damping of the mean-square oscillation amplitude. This analysis is extended so as to provide information on the manner in which the character of the amplitude distribution function may be affected by the damping procedure mentioned above. It is believed that information concerning the evolution of the form of the distribution function may be of particular interest in cases in which a "halo" is imposed on the distribution by injection of a group of particles to supplement those in a beam that has already been subjected to appreciable feedback damping. Results of the analytic work is illustrated, and compared with the results of simulation computations.

INSTRUMENTATION

RADIATION INSTRUMENTATION

REFER ALSO TO CITATION(S) 6683, 6684

GENERAL DETECTORS AND MONITORS

REFER ALSO TO CITATION(S) 6704, 7492

7290 (CONF-770685—2) **Positron emission computed tomography using large area detectors.** Atkins, F.; Muehllehner, G.; Harper, P.V. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1977. Contract EY-76-C-02-0069. 19p. Dep. NTIS, PC A02/MF A01.

From 5. international conference on information processing in medical imaging; Nashville, Tennessee, USA (27 Jun 1977).

The use of large area, position sensitive devices for positron annihilation coincidence detection permit fully 3-dimensional reconstructions of the activity distribution. Since the detectors may remain stationary or be rotated during the study both longitudinal and transverse sections may be imaged. Some of the aspects of this imaging geometry and possible algorithms for these two modes of operation are discussed. Also included are some clinical and phantom studies obtained with a positron camera designed around two Searle LFOV cameras.

7291 (COO—3333-30) **New imaging systems in nuclear medicine. Technical progress report, October 1, 1976—May 31, 1977.** Brownell, G.L. (Massachusetts General Hospital, Boston (USA)). 1977. Contract EY-76-S-02-3333. 43p. Dep. NTIS, PC A03/MF A01.

Work carried out on the development of instrumentation and techniques for positron scintigraphy is discussed. Progress in positron imaging instrumentation and applications is detailed. The assembly and initial evaluation of the new multicrystal positron camera, PC-II, has been completed. Images have been obtained in both two and three-dimensions which demonstrate the basic physical properties of the instrument. Successful measurements using transverse section imaging have been carried out on animals and human volunteers. Physiological investigation using PC-II is proceeding. A flexible and accurate computer program has been developed for transverse section reconstruction of data acquired by PC-II. This program makes it possible to reconstruct both the activity distribution and the distribution of absorption. The program has been developed in such a way that it can handle variations in the data collection procedure. Clinical studies using PC-I and PC-II are being carried on in areas of heart, lung and brain.

7292 (UCID—17563) **Mica fission detectors.** Wong, C.; Anderson, J.D.; Hansen, L.; Lehn, A.V.; Williamson, M.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Jun 1977. Contract W-7405-ENG-48. vp. Dep. NTIS, PC A02/MF A01.

The present development status of the mica fission detectors is summarized. It is concluded that the techniques have been refined and developed to a state such that the mica fission counters are a reliable and reproducible detector for fission events.

7293 **Multiwire proportional counter designed for microdosimetric studies.** Baily, N.A.; Steigerwalt, J.E. (Univ. of California, San Diego, La Jolla). *Radiat. Res.;* 71: No. 2, 284-299(Aug 1977).

A multiwire proportional counter has been constructed for use in microdosimetric studies. Its physical details and special preamplifiers are described. The dependency of its operational characteristics with respect to wire diameter, wire spacing, electrode spacing, and gas pressure are discussed. Experimentally determined performance levels are shown. Finally, experimental data depicting typical frequency distributions of energy deposition associated with the passage of 5.5-MeV α particles through the chamber are shown for both individual wires and the high-voltage planes.

RADIATION DOSEMETERS

REFER ALSO TO CITATION(S) 6619, 7505

7294 (CONF-771036—2) **Dosimeter sample preparation, quality assurance, and materials development for the ILRR, FRMDC, and FFTF dosimetry programs.** Adair, H.L.; Kobisk, E.H.; Setaro, J.A.; Quinby, T.C.; Dailey, J.M. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 19p. Dep. NTIS, PC A02/MF A01.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, California, USA (2 Oct 1977).

Since the IRML dosimeter program began in 1971, approximately 1900 vanadium encapsulated dosimeters and approximately 100 aluminum encapsulated metal fission foils have been prepared to meet TLRR, FRMDC, and FFTF requirements. Development efforts have focused on cost reduction in fabrication as well as characterization of both pure and dilute materials to meet the desired accuracy goals of +-0.5 and +-1.0 percent (2 sigma), respectively. One important requirement of the dosimeter program is that the dosimeter materials be encapsulated in high purity vanadium. To meet this requirement over the next ten years, an adequate supply of vanadium must be maintained. Efforts were begun to locate and characterize batches of high purity vanadium to meet this requirement. In addition, efforts were initiated to obtain the necssary vanadium capsules, to be fabricated from ILRR material, on a competitive bid basis from a commercial supplier. Quality assurance procedures were established to maintain homogeneity among the various batches of dosimeters produced. Procedures developed for producing the 1.270-mm diameter capsules were adapted to the loading of the more recently required 0.889-mm diameter capsules. Vanadium capsules are to be used in neutron energy spectra, flux and fluence characterization studies during start-up and run phases of the FFTF.

7295 (COO—323-39) **Special problems in nuclear instrumentation. Progress report, September 1, 1976—November 30, 1977.** Spokas, J.J. (Illinois Benedictine Coll., Lisle (USA). Physical Sciences Lab.). Aug 1977. Contract EY-76-S-02-0323. 19p. Dep. NTIS, PC A02/MF A01.

Three research programs are briefly outlined. The extraneous charge movements in coaxial and triaxial cables which are used to carry currents generated in ionization chambers have been the subject of further studies. Also, information pertaining to the preparation and properties of various conducting solid mixtures which have been developed in the Physical Sciences Laboratory is being collected and organized for a special report covering this subject. A new mixture which simulates cortical bone has been prepared and partially evaluated. The standard formulation, A-150, which was introduced as an equivalent for muscle relative to photons and neutrons has been duplicated successfully. Also, fundamental dosimetry studies of the high energy neutron therapy beam at Fermi National Accelerator Laboratory have been initiated.

7296 **Thermoluminescence response of LiF to gamma rays.** Jain, V.K.; Kathuria, S.P. (Bhabha Atomic Research Centre, Bombay). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 227-230(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

The thermoluminescence of lithium fluoride shows twelve peaks, of which II (100°C), III (135°C), and V (190°C) grow linearly first and then become nonlinear, eventually saturate and finally show decreased response or damage. Peaks beyond the Vth peak on the other hand seem to grow supralinearly right from the beginning. None of the available explanations for the supralinearity of the dosimetry peak (V) is entirely satisfactory. Similarly damage too is not understood. It has been shown that the radiation induced sensitization is linked with the XIIth peak (400°C). It is postulated that this peak is created as a result of irradiation and hence is supralinear right from the beginning. The other high temperature peaks, though supralinear, are not found to be responsible for radiation induced increase in sensitivity of lower temperature peaks. It is shown that the trap centers (TC's) responsible for the XIIth peak are generated as a result of the break up of complex centers TCLC's on irradiation. This break also causes the addition of luminescence centers (LC's) which leads to increase in sensitivity. The complex centers (TCLC's) themselves are formed due to the 400°C annealing. Decreased response or damage after saturation is the result of loss of luminescence centers while the traps remain unaffected.

7297 **Change in TL sensitivity of quartz due to stress.** David, M.; Ganguly, A.K. (Bhabha Atomic Research Centre, Bombay). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 231-233(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

Stress and strain caused by progressive and impact pressure loading can change the TL sensitivity of natural quartz. Stress due to progressive loading enhances the TL sensitivity considerably. It is found that sensitization increases as the amount of stress increases and reaches a maximum at about 1400 kg cm^{-2}. The TL sensitization obtained is correlated to "strain hardening" by the dislocation nets produced by stress. In the case of stress caused by impact loading, TL sensitivity is reduced. This may be due to the conversion of quartz to a glassy state at a high stress.

7298 **ESR—TL correlation studies in $CaSO_4$(RE) phosphors.** Nambi, K.S.V. (Bhabha Atomic Research Centre, Bombay). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 234-237(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

ESR and TL glow curve measurements were done after gamma irradiation at room temperature of $CaSO_4$ samples doped individually with all the lanthanide series rare earth (RE) elements, a yttrium doped sample and a few undoped samples of different origins. Samples were prepared in the laboratory using standarized techniques and concentration of the dopant in individual doped samples was maintained at a typical value of 0.1 percent by weight in $CaSO_4$. ESR as well as the TL glow curve patterns of all the sixteen samples were almost identical excepting for relative intensity differences. By observing the buildup of these signals with increasing gamma dose and also by following the decay of these for storage at room temperature, it could be inferred that the nature of the trapping species indicated in the ESR and TL glow curve patterns are the same. The behavior of these patterns for various thermal annealings at different temperatures have revealed that the trapping species might have configurations like SO_4^-, SO_3^-, O_3^- etc. having different thermal stabilities and these are responsible for the observation of the multi-peak TL glow curve structure involving a variety of thermal activation energies. The increased intensities observed in the ESR and TL signals of the differently doped samples indicate that presence of various RE impurities in $CaSO_4$ enhances to different extents the stabilities of these trapped species after gamma irradiation.

NUCLEAR SPECTROSCOPIC INSTRUMENTATION

7299 (COO—2231-38) **Energetic-neutron spectrometry. Progress report, 1 June 1976—31 August 1977.** Madey, R. (Kent State Univ., Ohio (USA)). 1977. Contract EY-76-S-02-2231. 20p. Dep. NTIS, PC A02/MF A01.

Advances in instrumentation and techniques for energetic-neutron spectrometry include the development of large-volume scintillators and a mean-timer electronic module to provide subnanosecond timing resolutions for time-of-flight measurements with improved energy resolutions, new determinations of the light response to protons (relative to electrons) of NE-228, NE228A, NE-224, and NE-102 scintillators, and the development of a multiplexing technique to permit the operation of several different counters simultaneously with our transportable data-acquisition system. Measurements demonstrating and utilizing these advances include neutron energy and angular distributions from 710-MeV alphas stopping in thick targets, and neutron spectra and yields from the nuclear capture of negative pions. Included also is a discussion of a planned experiment to measure neutron spectra from heavy-ion reactions at the Lawrence Berkeley Bevalac.

7300 **Utilization of plastic scintillator in the measurement of uncharged radiations.** Sarkar, P.K.; Kirthi, K.N. (Bhabha Atomic Research Centre, Bombay). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 247-251(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

Uncharged radiations like neutrons and gamma rays produce scintillations in plastic scintillator through secondary charged particles. The energy distributions of these recoil particles are related to the energy distribution of the incident radiation. An attempt has been made in the present work to get back the original incident spectrum from the recoil distribution. The computer code UNFOLD designed for the purpose makes a minimum-variance, maximum likelihood estimate of the incident spectrum by iterative least square technique. Neutron spectra from different Be(α,n) sources and ^{252}Cf spontaneous fission have been measured. The results agree well with those published. Plastic scintillators prove to be more useful when the incident gamma spectrum is continuous in nature because the Compton continuum produced in the scintillator has a well defined integral relationship with the incident gamma spectrum. Continuous gamma spectrum in the Apsara reactor beam hole has been estimated using the technique developed.

7301 **Neutron spectrometry by sandwich surface barrier technique.** Joneja, O.P. (Bhabha Atomic Research Centre, Bombay). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 252-254(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

A neutron spectrometer using silicon surface barrier detectors employed ^6LiF as a radiating material is developed. An incident neutron interacts with the radiating atom resulting in two charged particles, which are detected by sandwich detector geometry and the corresponding sum pulses from both the detectors shall uniquely define the incident neutron energy. Results obtained by Monte Carlo simulation of all the correction factors for the detector head employed are presented. A new concept for resolution correction is developed which brings down the lower energy limit of the detector system. The spectrometer is employed for incore spectrum studies in case of a thermal reactor "Kahter" and the results obtained exhibit a good agreement with that of calculations by GAM THERMOS EXTERMINATOR Code.

HIGH ENERGY PHYSICS INSTRUMENTATION

7302 (BNL—23234) **New developments on transition radiation detectors using superconducting granules.** Yuan, L.C.L. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 10p. (CONF-770596—1). Dep. NTIS, PC A02/MF A01.

From International symposium on transition radiation of high energy particles; Yerevan, Armenia, USSR (12 May 1977).

By raising slightly either the temperature or the magnetic field to above that of the critical temperature or the critical magnetic field, the type I superconducting granules would still remain in the superconducting state which becomes a metastable state and is called the superheated superconducting state. If a relativistic charged particle incident on such a granule which is located in a colloidal suspension has imported to it an energy that is above the threshold energy (for state flipping) of the granule then it would flip to the normal state. The threshold energy of a granule is a function of the square of its radius, whereas the energy loss of a charged particle due to ionization is linearly proportional to the radius. The size of the granule can be pre-determined to be such that its threshold energy is slightly above the ionization loss of a relativistic charged particle. Then the traversal of the charged particle through such a granule would not affect the superconducting state of the granule unless a transition x-ray radiation is emitted at the surface of the granule by the traversing particle and the x-ray transition radiation is immediately absorbed either in total or partially by the metallic granule causing it to flip to the normal state. The total intensity of the x-ray transition radiation is linearly proportional to the Lorentz factor γ of the traversing particle, and the number of granules flipped would also be a measure of γ. Three methods for detecting the flipping of granules from the superconducting state to the normal state are described. They include the frequency measuring method, the SQUID method, and the pulse method with low noise amplifier system. (WHK)

RADIOMETRIC INSTRUMENTS

7303 (SAND—77-1568C) **Non-contacting beta backscatter gage for explosive quantity measurement.** Higgins, P.B.; Mathews, F.H.; Benham, R.A. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 30p. (CONF-771049—1). Dep. NTIS, PC A03/MF A01.

From 48. shock and vibration symposium; Huntsville, Georgia, USA (19 Oct 1977).

A non-contacting method of measuring the quantity of light-initiable explosive previously applied to a surface is described. Design parameters, calibration procedures and field results are given for a beta backscatter gage which measures the areal density of a layer of the primary explosive, silver acetylide-silver nitrate (SASN), on a carbon or aluminum sub-surface. The "radiation patterns" produced by the gage using three different beta source geometries were determined and their relative merits are discussed.

RADIATION EFFECTS ON INSTRUMENT COMPONENTS, INSTRUMENTS, OR ELECTRONIC SYSTEMS

REFER ALSO TO CITATION(S) 7194, 7295

7304 (SAND—76-5554C) **Development of efficient, radiation-insensitive GaAs:Zn LEDs.** Barnes, C.E. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 25p. (CONF-770714—6). Dep. NTIS, PC A02/MF A01.

From IEEE conference on nuclear and space radiation effects; Williamsburg, Virginia, United States of America (USA) (12 Jul 1977).

Although amphoterically Si doped GaAs LEDs are commercially popular because of their high light output, they are extremely sensitive to irradiation. Therefore, it would be desirable to have a viable alternative available for radiation environment applications. In this work it is shown that by increasing the hole concentration in the active region of nonamphoterically doped GaAs LEDs, one can simultaneously achieve high light output and low radiation sensitivity. Experimental results indicate that the minority carrier lifetime is smaller in more heavily doped devices so that the lifetime-damage constant, tau/sub o/K, is also smaller. Hence, the heavily doped devices should have greater radiation hardness. Neutron-induced light output degradation data as a function of hole concentration confirm this conclusion. The results also show that the pre-irradiation light output is greatest in the heavily doped LEDs. The accompanying decrease of tau/sub o/ in the heavily doped devices indicates that the total minority carrier lifetime is at least partially controlled by the radiative lifetime; a requirement for simultaneously achieving radiation hardness and high initial light output. Finally, an experimental comparison with amphoterically Si doped LEDs shows

that the heavily doped devices are superior for neutron fluences greater than 2×10^{12} n/cm^2.

7305 (SAND—77-1500C) **Degradation of EMP hardening devices.** Maxam, G.L.; Solberg, J.E. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 43p. (CONF-771044—1). Dep. NTIS, PC A03/MF A01.

From EMP environments and protection implementation seminar; Eglin Air Force Base, Florida, USA (4 Oct 1977).

In field applications, systems containing hardening devices will be subjected to a wide range of environments which may cause the effectiveness of the devices to degrade with time. Studies of the degradation of three hardening techniques, filtering, cable shields, and conductive gaskets are reported. The shielding effectiveness of double shielded cables was measured both before and after the cables were subjected to a series of bending, twisting, and environmental tests. The shielding effectiveness was found to degrade from the expected 60 dB to about 30 dB at some frequencies. Measurements on filter packs in systems subjected to field environments showed that the filters which had been expected to provide 50 dB of attenuation actually provided much less. Conductive gaskets are known to take a set when compressed for a long period of time. Measurements of the electromagnetic integrity of a sample gasket material under varying pressures were made.

MISCELLANEOUS INSTRUMENTS

REFER ALSO TO CITATION(S) 5813, 7370

7306 (BDX—613-1373(Rev.)) **Platinum resistance thermometer calibration on the international practical temperature scale of 1968.** Drake, S.R. (Bendix Corp., Kansas City, Mo. (USA)). Jul 1977. Contract EY-76-C-04-0613. 54p. Dep. NTIS, PC A04/MF A01.

A method using the defined equations of the International Practical Temperature Scale of 1968 (IPTS-68) for calibrating platinum resistance thermometers in the range from -182.962 to +630.74°C is described. Incorporating the specified IPTS-68 procedure, the method also provides for the accommodation of additional data points in both the negative and positive scale regions at any desired temperature level. The PRT68 computer program, also described and illustrated, was written in FORTRAN language for the CDC-6600 computer to implement this method.

7307 (CONF-770855—2) **New HVEM for materials research at ANL.** Lyles, R.L.; Merkle, K.L.; Okamoto, P. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 6p. Dep. NTIS, PC A02/MF A01.

From 5. international conference on high voltage electron microscopy; Kyoto, Japan (29 Aug 1977).

The Argonne National Laboratory HVEM facility will be used primarily in support of basic materials studies on problems of interest to various energy technologies. The nucleus of the ANL facility is an improved AEI EM-7 high-voltage electron microscope with an accelerating voltage of 1.2 MV and a guaranteed resolution of 5 A point-to-point. The installation of this instrument is the first step in the development of a materials research laboratory, which, when completed, will include interfaces with a 2-MV tandem accelerator and a low-energy ion injector for in-situ ion-irradiation and ion-beam analysis experiments. In addition to the HVEM-ion-accelerator link, several features that will significantly enhance the usefulness of the instrument for materials research have been incorporated into its design. These include direct ion pumping of the high vacuum specimen chamber with a vacuum level of 10^{-7} torr, a negative-ion trap, instrumentation for the selection of two independently adjustable dark-field conditions, facilities for continuous-mode acdelerating voltage selection at the operator console, and a special Swann-type environmental chamber. Also, a low-temperature, side-entry He stage is being designed and constructed at ANL. The He stage is intended to be used for observation as well as in-situ residual-resistivity measurements below 10 K. In addition to the He stage, a separate low-temperature (<20 K) cold shield and anticontaminator is being designed that will permit cryogenic pumping with standard stages.

7308 (COO—913-67) **Digital spectrometer scan controller.** Wilson, L.R.; Johnston, D.B. (Minnesota Univ., Minneapolis (USA). Dept. of Chemistry). 1977. Contract EY-76-S-02-0913. 15p. Dep. NTIS, PC A02/MF A01.

An electronic device for control of a stepping motor scanned spectrometer is described. The device digitally displays wavelength, stops a scan at a preset wavelength and remotely controls a strip chart recorder. The primary utility of the device is in obtaining precise wavelength reproducibility in recorded spectra.

7309 (LBL—6480) **Performance studies of varian VPM-154D.6D VPM-154A/1.6L static crossed field photomultipliers.** Lo, C.C.; Leskovar, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 17 Jun 1977. Contract W-7405-ENG-48. 25p. Dep. NTIS, PC A02/MF A01.

Characteristics have been measured for the Varian VPM-154D.6D and VPM-154A/1.6L Static Crossed Field Photomultipliers. Some typical photomultiplier characteristics such as: gain, dark current, quantum efficiency, and rise-time--are compared with data provided by the manufacturer. Photomultiplier characteristics generally not available from the manufacturer, such as: transit time, FWHM of the output pulse, peak output current measurement and multiphotoelectron time resolution were measured and are discussed.

7310 (LBL—6498) **Transit time spread measurements of microchannel plate photomultipliers.** Keskovar, B.; Lo, C.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 4 Apr 1977. Contract W-7405-ENG-48. vp. (CONF-770976—1). Dep. NTIS, PC A02/MF A01.

From Conference on precise electrical measurement; Brighton, UK (5 Sep 1977).

An investigation of the single photoelectron and multi-photoelectron transit time-spread performance of prototype photomultipliers using curved high-gain microchannel plates for electron multiplication and proximity focusing for the input and collector stages is reported. A microchannel plate consists of a closely packed two dimensional array of very small diameter, short channel-electron multipliers. Each single channel electron multiplier is a continuous glass tube whose inside surface has a high resistance semiconducting coating used a a secondary electron-emitting surface. Measurement of the transit time spreads of the HR350 and HR400 photomultipliers (made by the Laboratories d'Electronique et the Physique Appliquee) using a specially developed very high resolution measuring system are described. The experimental data are compared with results obtained on conventional fast photomultipliers. (WHK)

7311 (LBL—6707) **Fast timing discriminator.** Lo, C.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 11 Jul 1977. Contract W-7405-ENG-48. 23p. Dep. NTIS, PC A02/MF A01.

The processing of pulses with very fast risetimes for timing purposes involves many problems because of the large equivalent bandwidths involved. For pulses with risetimes in the 150 ps range (and full widths at half maximum (FWHM) of 400 ps) bandwidths in excess of 1GHz are required. Furthermore, these very narrow pulses with current amplitudes as small as 1 mA carry very small charges ($<10^{-12}$ coulomb), therefore, requiring very sensitive trigger circuits. The difficulty increases when timing characteristics in the picosecond range are sought especially when a wide input signal amplitude range causes a time-walk problem. The fast timing discriminator described has a time-walk of approximately +-75 ps over the input signal range from 80 mV to 3V. A schematic of the discriminator is included, and operation and performance are discussed.

7312 (MHSMP—77-51) **Firing site objective lens mounts. Period convered: October—December 1976.** Avara, G.R. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1976. Contract EY-76-C-04-0487. 6p. Dep. NTIS, PC A02/MF A01.

Objective lens mounting systems were designed and installed at the test site bunkers. These systems will accept a variety of lens diameters and assure that a lens is optically aligned to the streak camera and other optical components. Lenses can be quickly installed (or interchanged) at various bunkers.

7313 (MHSMP—77-41) **Image rotator alignment.** Avara, R. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). Jul 1977. Contract EY-76-C-04-0487. 6p. Dep. NTIS, PC A02/MF A01.

Pechan prisms are often utilized at the Pantex firing site to rotate a test part image for proper alignment to the streak camera slit plate. Modification of a prism mounting system provides means for the mutual adjustment of the prism axis, prism mounting axis, and streak camera optical axis. This reduces, or eliminates, image translation during rotation about the optical axis. Alignment errors, modification devices, and alignment procedures are presented for the rotational prisms employed at the test site.

7314 (MHSMP—77-47) **Divided-flow-apparatus.** Schnarr, C.E. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). Oct 1977. Contract EY-76-C-04-0487. 10p. Dep. NTIS, PC A02/MF A01.

Due to programmatic requirements a necessity developed for a system to rapidly and accurately calibrate dew point measuring devices. Two modes of operation appeared to be desirable, both "in-place" and "batch" operations. The system needed to be a generating type to produce the required dew point spectrum. The system also needed to be sensitive and stable, as the lower end of the spectrum is 5 parts per million by volume. After a number of different approaches, a mixing system evolved, and was called a "Divided-Flow-Apparatus". The device was capable of calibrating dew point

probes from -65°C to -20°C with an accuracy of 2°C. Operation of the system is briefly described.

7315 (SAND—77-0936C) **Piezoelectric sensor pen for dynamic signature verification.** EerNisse, E.P.; Land, C.E.; Snelling, J.B. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 8p. (CONF-771201—3). Dep. NTIS, PC A02/MF A01.

From IEEE international electron devices meeting; Washington, District of Columbia, USA (5 Dec 1977).

The concept of using handwriting dynamics for electronic identification is discussed. A piezoelectric sensor pen for obtaining the pen point dynamics during writing is described. Design equations are derived and details of an operating device are presented. Typical output waveforms are shown to demonstrate the operation of the pen and to show the dissimilarities between dynamics of a genuine signature and an attempted forgery.

7316 (SAND—77-1122C) **Digital data analysis technique for an ultrasonic ablation gauge.** Beattie, A.G. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 12p. (CONF-771022—1). Dep. NTIS, PC A02/MF A01.

From 9. national SAMPE technical conference; Atlanta, Georgia, USA (4 Oct 1977).

The development of an analysis procedure to reduce data from an ultrasonic ablation gauge is described. The procedure uses cross correlation functions computed by means of Fast Fourier Transforms to follow the echo in time.

7317 (SAND—77-8038) **Microprocessor-based system for determining the thickness of conductors on printed wiring boards.** Hopwood, J. (Sandia Labs., Albuquerque, N.Mex. (USA)). Sep 1977. Contract EY-76-C-04-0789. 46p. Dep. NTIS, PC A03/MF A01.

A microprocessor-based, stored-program controller which incorporates a floating-point arithmetic unit to perform complex mathematical computations has been developed to determine the thickness of conductors on printed wiring boards. Conductor thickness is calculated from measured resistance by means of curve-fitting routines in the stored program. Called a film thickness calculator, the instrument provides a rapid, efficient, in-process, nondestructive means for determining plating thicknesses on the surface and in plated-through holes.

7318 (TID—27621) **Future data bus requirements for laboratory high speed data acquisition systems.** Larsen, R.S. (ed.). (National Instrumentation Methods Committee (USA)). Jun 1977. 31p. Dep. NTIS, PC A03/MF A01.

This document is a report to the NIM Executive Committee on future data bus requirements for laboratory high speed data acquisition systems. It was prepared by the NIM Advanced Systems Study Group (ASSG) that was established to determine the "functional requirements for a next generation standard interface system."

7319 (UCRL—13733-3) **Estimators in sampling schemes, using imprecise linear instruments.** Kwiatkowski, J.W.; Jewell, W.S. (California Univ., Berkeley (USA). Operations Research Center). Jun 1977. Contract W-7405-ENG-48-3684703. 47p. (ORC—77-17). Dep. NTIS, PC A03/MF A01.

A model for measurements of some characteristic of a material using a linear instrument is considered. The instrument parameters are subject to random variation about their fixed (but unknown) means. Inputs may consist of samples from the material, or "standard" inputs for the purposes of calibration. Credibility formulae are used for estimating the characteristic of the material being measured, which is assumed to be a random variable with known prior mean and variance, and for updating estimates of the instrument parameters. Various special cases are considered where the material samples come from a hierarchical structure, and the efficiencies of some different sampling schemes are compared.

7320 (UCRL—80129) **Framing camera tube for the sub-100 picosecond range.** Kalibjian, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Sep 1977. Contract W-7405-ENG-48. 13p. (CONF-771040—2). Dep. NTIS, PC A02/MF A01.

From Electro-Optical systems conference; Anaheim, California, USA (25 Oct 1977).

An electronic framing camera tube featuring focal plane image dissection and synchronized restoration of the dissected electron line images to form two-dimensional framed images has been developed. Ultra-fast framing is performed by first streaking a two-dimensional electron image across a narrow slit, thereby dissecting the two-dimensional electron image into sequential electron line images. The dissected electron line images are then restored into a framed image by a restorer deflector operated synchronously with the dissector deflector. The number of framed images on the tube's viewing screen is equal to the number of dissecting slits in the tube. The distinguishing features of this ultrafast framing camera tube are the focal plane dissecting slits, and the synchronously-operated restorer deflector. The framing camera tube can produce image frames having high spatial resolution of optical events in the sub-100 picosecond range.

7321 **Laser two-photon excited fluorescence detection for high pressure liquid chromatography.** Sepaniak, M.J.; Yeung, E.S. (Iowa State Univ., Ames). *Anal. Chem.;* **49**: No. 11, 1554-1556(Sep 1977).

A laser two-photon excited fluorometric detector for high pressure liquid chromatography is described and characterized for the separation of the oxadiazoles PPD, PBD, and BBD. Excitation is provided by the absorption of two photons of radiation at 5145 A from an argon ion laser. The detection limits, linearity of response, precision, and selectivity are reported and are found to compare favorably with other UV detection methods.

7322 **Temperature exposure measured by the use of thermoluminescence.** Romberg, G.P.; Prepejchal, W.; Spigarelli, S.A. (Argonne National Lab., IL). *Science;* **197**: No. 4311, 1364-1365(Sep 1977).

A method has been developed to measure temperature exposure based on the use of the temperature-dependent property of thermoluminescence fade. This property provides a relatively simple and inexpensive method for measuring both average and accumulated temperature exposure without the need for sophisticated temperature-recording equipment.

WELL LOGGING INSTRUMENTATION

REFER ALSO TO CITATION(S) 5852, 5910, 6409

7323 **Method and apparatus for logging earth boreholes.** Angehrn, J.A. (to Dresser Industries, Inc.). US Patent 4,041,780. 16 Aug 1977. Filed date 3 May 1976. 12p.

A self-contained, battery powered well logging instrument is pumped down the interior of a drill pipe string having a catcher sub at its lower end. When the logging instrument latches into the catcher sub, the pumped fluid circulation is blocked, after which increased pump pressure switches a valve assembly to recreate circulation and energize the logging instrument to the standby position. An accelerometer in the logging instrument detects the upward movement of the instrument and switches the circuitry from standby to the record mode. The output from a clock controlled by the downhole accelerometer is recorded along with the logging information and is synchronized with pipe footage measurements and with a similar such accelerometer and clock at the earth's surface which are responsive to the movement of the pipe string at the earth's surface. The recorded logging samples are thus related to true depth by correlating with the data simultaneously recorded at the earth's surface. As an alternative embodiment, the logging instrument is attached to the drill pipe prior to running the pipe into the borehole.

7324 **Inversion of seismograms and pseudo velocity logs.** Lavergne, M.; Willm, C. (Institut Francais du Petrole, Rueil-Malmaison, France). *Geophys. Prospect.;* **25**: No. 2, 231-250(Jun 1977).

Pseudo velocity logs can be obtained by seismogram inversion, using true amplitude processing and detailed investigation of move-out velocities. The precision of the results depends on the quality of the seismic data and on the possibility of deconvolving without increasing the noise. An investigation is made of the deformation of pseudo logs due to seismic signal variations and to imperfections of deconvolution. Both marine and land examples are shown, in some cases with adjustment on well logs. When the dips are large, time sections must be migrated and pseudo velocity logs must be computed from migrated sections. Comparison of sonic logs with pseudo velocity logs obtained in the same area is usually good enough to obtain information on lithological parameter variations by adjustment of pseudo velocity logs on sonic logs. Even when no well is available, pseudo velocity logs can give some indications on the nature of sediments between seismic horizons.

EXPLOSIONS AND EXPLOSIVES

CHEMICAL

REFER ALSO TO CITATION(S) 7303

7325 (MHSMP—77-5B) **Mechanical sensitivity of PBX 9501. Period covered: October—December 1976.** van Velkinburgh, J.H. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1976. Contract EY-76-C-04-0487. 6p. Dep. NTIS, PC A02/MF A01.

Skid tests, vertical drop tests and drop hammer tests were done on PBX 9501 (nominal composition 95.0/2.5/2.5 HMX/Estane

5703-F1/DNPAF) to determine its sensitivity to mechanical stimuli. The sensitivity of PBX 9501 is considered to be very low.

7326 (MHSMP—77-5C) **Physical properties and sensitivity of HMX/Estane 5713 and HMX/Estane 5714. Period covered: October—December 1976.** van Velkinburgh, J.H. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1976. Contract EY-76-C-04-0487. 9p. Dep. NTIS, PC A02/MF A01.

Two small lots of LX-14 having the Estane 5702-F1 replaced with Estane 5713 and 5714 were formulated. The two formulations were subjected to skid tests, tensile tests, and drop hammer tests. These tests were intended as preliminary screening tests of the two Estanes to evaluate their potential as binder materials.

7327 (MHSMP—77-5H) **FEFO degradation in LX-09. Period covered: October—December 1976.** Switzer, S.T. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1976. Contract EY-76-C-04-0487. 10p. Dep. NTIS, PC A02/MF A01.

A study of FEFO degradation in several 1969 neat FEFO library samples and FEFO extracted from library LX-09 lots prepared using these samples was made by gas chromatography.

7328 (MHSMP—77-5J) **Light production at an explosive/air interface. Period covered: October—December 1976.** Canada, C.E. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1976. Contract EY-76-C-04-0487. 10p. Dep. NTIS, PC A02/MF A01.

Detonation front arrival time measurements are compared for an optoelectronic and an antenna technique. Fiber optics and photodiodes are used for the optoelectronic method while the antenna technique depends on radiated signals at an explosive/air interface. Analysis indicates that signals measured by the respective techniques are not caused by the same physical mechanism; thus, even though the results are not directly comparable the signals should be self-consistent for a given technique. The optical signals were found to have greater jitter in time and larger variation in magnitude than those signals obtained by the antenna technique.

7329 (MHSMP—77-5L) **Investigation of the effect of binder crystallinity on the mechanical properties of a plastic bonded explosive. Period covered: October—December 1976.** Myers, L.C.; Johnson, H.D. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1976. Contract EY-76-C-04-0487. 17p. Dep. NTIS, PC A02/MF A01.

The tensile properties of a plastic bonded explosive RX-03-BB were investigated as a function of the degree of crystallinity of the plastic binder. This investigation was to determine if stress/strain properties of RX-03-BB would be affected by an increase in the crystallinity of the Kel-F 800 binder. RX-03-BB composition is 92.5%/7.5% TATB/Kel-F 800. Forty-four tensile test specimens were machined from a single pressing of RX-03-BB. These specimens were divided into three groups. Group I specimens were ambient controls, Group II specimens were conditioned at 50°C for 1, 2, and 3 months. Group III specimens were conditioned the same as Group II but before testing they were heated to 100°C and held for 2 h. All specimens were testing at 21°C. The data from this investigation showed no significant difference in the ultimate stress of the three groups but Group III with reduced crystallinity gave a greater percentage strain then either of the other two groups.

7330 (MHSMP—77-23) **Cyclic recrystallization of Sandia furnished HNS I. Final report.** Quinlin, W.T. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). Jul 1977. Contract EY-76-C-04-0487. 4p. Dep. NTIS, PC A02/MF A01.

The Pantex HNS recrystallization process followed by a crystal altering step was used to modify 4.77 kg of Sandia furnished HNS IB. The resulting HNS II (2.04 kg) was evaluated by the Navy specification WS-5003 as modified by Sandia Laboratories. The HNS II (Lot 6201-137-01) was shipped to Sandia.

7331 (UCRL—79117) **Theoretical studies of shock-initiated detonations.** Karo, A.M.; Hardy, J.R.; Walker, F.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Aug 1977. Contract W-7405-ENG-48. 18p. (CONF-770803—3). Dep. NTIS, PC A02/MF A01.

From 6. international colloquium on gasdynamics of explosions and reactive systems; Stockholm, Sweden (22 Aug 1977).

The dynamics of shock propagation have abeen studied theoretically for a variety of two-dimensional lattices. The approach used is based on molecular dynamics and hinges on the exact numerical solution by computer of the equations of motion for the individual atoms or molecules in each lattice. Shocks have been launched into the lattices under study by methods designed to simulate flyer-plate impact. Two different interatomic potentials have been used, one endothermic and one net-exothermic. For both types of potential, a shock launched at one side of the lattice will spall a group of atoms off the other side. However, the subsequent behavior of the two types of lattice is very different. For endothermic potentials, after the initial atomic spall, the residual lattice is quiescent with little further activity. For net-exothermic potentials, the initial atomic spall injects additional energy into the system in such a manner that subsequently further spall occurs at both sides. Once this new spall is initiated, it leads rapidly to further bond breaking and explosive disintegration of the system.

7332 (UCRL—79612) **Molecular dynamics of shock-initiated detonations.** Karo, A.M.; Hardy, J.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Aug 1977. Contract W-7405-ENG-48. 15p. (CONF-770851—1). Dep. NTIS, PC A02/MF A01.

From International symposium on quantum chemistry; Uppsala, Sweden (31 Aug 1977).

Results of computer studies of shock propagation in a pair of two-dimensional finite lattices are reported. The first is bonded by a Morse potential acting between first and second neighbors, while the second is similarly bonded by a potential that simulated the effect of an exothermic chemical reaction. For the Morse potential, bond breaking is endothermic, but for the other potential bond breaking is an exothermic process. Shocks launched into either of these lattices are strongly localized, stable disturbances, with violent structure on the atomic scale. This localization and stability enable shocks launched into either lattice to transverse the structure and spall atomic fragments off the edge. Most of the shock energy is imparted to the spalled fragment. After spall, the remainder of the endothermically-bonded lattice is quiescent, although there is significant activity in the spalled fragment. However, for the exothermically-bonded lattice, the spalled fragment rapidly disintegrates after spall and the energy fed back into the bulk of the crystal during the initial spall leads to further spall of atoms from the edges. This process grows rapidly, ultimately totally destroying the crystal. Results show that the situation in both shocked lattices is highly nonergodic. This conclusion, together with the complex, rapidly varying shock structure, indicates that the behavior of shocked solids can only be truly understood from study of them at the atomic level, where continuum mechanics, equilibrium thermodynamics, equilibrium statistical mechanics or all three may be inapplicable.

NUCLEAR

REFER ALSO TO CITATION(S) 7260

7333 (USGS—474-183) **Catalog of seismic records obtained in support of the ERDA/Nevada Operations Office, October 1963—June 1976.** Navarro, R.; Sembera, E.D.; Jungblut, W.L. (Geological Survey, Las Vegas, Nev. (USA)). Sep 1977. Contract EY-76-A-08-0474. 134p. Dep. NTIS, PC A07/MF A01.

The report lists records from all announced tests for the period September 13, 1963 through June 1976 and includes records from nuclear weapons tests on and off the NTS; all Industrial Application Division (IAD) (Plowshare) tests; and other research studies conducted during the period. High explosive experiments, wind and human-force vibration of structures, and earthquakes are also listed.

WEAPONRY

7334 (SAND—77-8175) **Study of breakthrough operations. Final report.** Dupuy, T.N.; Hayes, G.P.; Martell, P.; Lyons, V.E.; Andrews, J.A.C. (Historical Evaluation and Research Organization, Dunn Loring, Va. (USA)). Oct 1976. Contract EY-76-C-04-0789. 211p. (DNA—4124F). Dep. NTIS, PC A10/MF A01.

The purpose of the study was to examine breakthrough operations in past wars of recent history so as to provide a basic understanding of the essentials of such operations, and to assist those in the nuclear community who are modeling breakthrough operations, as well as those decision-makers who will shape the US capability to defeat a potential breakthrough in conventional or tactical nuclear combat. The twelve operations selected were: (1) Megiddo Campaign, September 19 to 21, 1918; (2) Battle of Flanders, May 10 to 21, 1940; (3) Ukraine Invasion, June 21 to 26, 1941; (4) Battle of Jitra, Malaya, December 8 to 12, 1941; (5) Leningrad Breakthrough, January 12 to 18, 1943; (6) Operations "Citadel" (Kursk), July 4 to 15, 1943; (7) Belgorod-Kharkov Offensive, August 3 to 11, 1943; ((8) Operation "Cobra" (Normandy), July 24 to 28, 1944; (9) Battle of Mutangkiang, Manchuria, August 9 to 15, 1945; (10) Korean Invasion, June 25 to 28, 1950; (11) Second Sinai Campaign, June 5 to 8, 1967; and (12) Golan Heights Assault, June 9 to 10, 1967.

EXPLOSION DETECTION

7335 **Spectral characteristics of the P codas of eurasian earthquakes and explosions.** Evernden, J.F. (Geological Survey, Menlo Park, CA). *Bull. Seismol. Soc. Am.;* 67: No. 4, 1153-1171(Aug 1977).

Spectral analysis of "infinite velocity sum" subarray beams at LASA for the P codas of 36 explosions and 23 earthquakes indicates the presence of 6 to 9 Hz energy well above noise level for large explosions and earthquakes. A discriminant (D), based on use of the full spectral bandwidth from 0.4 to 9 Hz, successfully discriminates all Eurasian explosions and shallow-focus earthquakes. The basic character and contrast in spectral composition of the source spectra of earthquakes and explosions is discussed. It is pointed out that the discriminant (D), when use is made of signals recorded in the range 60° to 90°, is as or more successful in discriminating events of near m/sub b/ 4.0 as those at and above m/sub b/ 6.0, and the basis for this success is clarified. It is suggested that proper use of P coda spectral discriminants appears capable of achieving identification essentially at the detection threshold of a network, while circumventing such problems as refined depths of focus, mixed events, etc.

ENVIRONMENTAL SCIENCES, ATMOSPHERIC

REFER ALSO TO CITATION(S) 7180

BASIC STUDIES

REFER ALSO TO CITATION(S) 6439, 6871

7336 (BNL—23146) **Statistical correlations of the wave-induced atmospheric turbulence over the sea.** SethuRamam, S. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 13p. (CONF-771103—1). MF/A01.

From 5. conference on probability and statistics in atmospheric sciences; Las Vegas, Nevada, USA (15 Nov 1977).

The micro-meteorological processes that take place in the atmospheric surface layer over oceans can be broadly classified into two categories; transfer of momentum and energy from the wind to the water and, the perturbance of the wind field due to the propagation of waves. The purpose of this paper is to consider the latter process. When waves progress in water they induce an airflow in the initially still air close to the waves with the mean component in the direction of the waves. Over an open ocean, such a situation commonly occurs when waves with swell frequencies propagate in a locally calm meteorological condition. The influence of the swells will be felt even when there is a moderate wind locally. Another characteristic of the above process is the perturbations in the wind velocity fluctuations due to the presence of the waves. Data are reviewed from several theoretical and field studies on disturbances.

7337 (BNWL-SA—6231) **Microclimates of the arid lands ecology reserve, 1968—1975.** Thorp, J.M.; Hinds, W.T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1977. Contract EY-76-C-06-1830. 108p. Dep. NTIS, PC A05/MF A01.

The climatology of the Hanford Reservation Arid Lands Ecology (ALE) Reserve does not end, of course, with this report. As this goes to press the arid lands of eastern Washington are experiencing the driest winter in 65 years of record. Even without including this winter's (1976-77) data in our summaries here, we have been fortunate to have had a very dry winter (1972-73) and a very wet winter (1973-74) occur within our first 8 years of climatological measurements on the Reserve. Our primary purpose with this report has been to analyze the first 8 years of climatological measurements from the ALE Reserve and to identify persistent spatial variations between stations or groups of stations. From these variations we have been able to recognize several distinct, but related microclimates occurring within the Reserve. Secondly, we have shown that significant correlations exist between each microclimate on the Reserve and that of the Hanford Meteorological Station nearby. These correlations, coupled with the 30-year weather record at the HMS and possibly with the 32-year (1912-1944) record at the Hanford townsite, allow ALE Reserve temperature and precipitation estimates to be made for years prior to the ALE climatology program.

7338 Wind tunnel investigation of plume dispersion in the vicinity of a surface mounted cube. I. The flow field. Robins, A.G.; Castro, I.P. (Marchwood Engineering Labs., Hampshire, Eng.). *Atmos. Environ.;* **11**: No. 4, 291-297(1977).

In order to understand the processes involved in plume dispersion in the vicinity of large buildings it is vital to obtain knowledge concerning the velocity and turbulence fields associated with both the approach flow and the building wake. An investigation was undertaken of the flow about a surface mounted cube in a simulated atmospheric boundary layer, the cube height being one tenth of the boundary layer height. The structure and development of the undisturbed boundary layer are described and some comparisons made with full scale measurements. The results of an investigation of the mean pressure forces on, and the flow around, the cube are presented and discussed. Qualitative conclusions are drawn concerning a number of important effects of body orientation and approach flow characteristics.

7339 Wind tunnel investigation of plume dispersion in the vicinity of a surface mounted cube. II. The concentration field. Robins, A.G.; Castro, I.P. (Marchwood Engineering Labs., Hampshire, Eng.). *Atmos. Environ.;* **11**: No. 4, 299-311(1977).

The concentration field downstream of a source can be significantly modified by the presence of large buildings. In order to observe some of the effects of large buildings on plume dispersion an investigation has been made of diffusion in the vicinity of a surface mounted cube in a simulated atmospheric boundary layer. The cube height was one tenth of the boundary layer height and the concentration measurements extended to 40 cube heights downstream of the cube. Releases from sources in the surface of the cube and from a stack above the center of the roof were considered. The results are compared with measurements made in the absence of the cube and some of the main effects of the cube thus illustrated. The significance of the wind direction, stack height and emission velocity ratio are discussed, as is the influence of the flow field in the vicinity of the cube. It is shown that the concentration field beyond about two cube heights from the source can be adequately described by the use of effective source height concepts. Finally, the data are compared with the findings of other experimental investigations of dispersion in the vicinity of buildings.

7340 Chemical reactions in the atmosphere as studied by the method of instantaneous rates. Johnston, H.S.; Whitten, G. (Univ. of California, Berkeley). *Int. J. Chem. Kinet.;* **7**: No. Suppl. 1, 1-26(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The photochemistry of ozone in the stratosphere was studied using the method of instantaneous rates. By a Monte Carlo method it is very improbable that random experimental errors in the basic kinetic constants are responsible for the failure of the classic Chapman mechanism and air transport to account for the natural O_3 balance. It is probable that the observed concentration of nitrogen dioxide in the stratosphere is sufficient to account for the natural O_3 balance. There is a strong latitude dependence on the sensitivity of stratospheric O_3 to catalytic destruction by the oxides of nitrogen. Considerations based on the classic photochemical sector method show that there is no average intensity over the diurnal cycle that is appropriate for stratospheric O_3. The crossover point between O_3 formation from the methane-nitrogen oxides smog reaction and O_3 destruction by NO/sub x/ catalysts occurs at about 13 km in temperature latitudes.

7341 Photolysis of NO_2 and collisional energy transfer in the reactions $O + NO \rightarrow NO_2$ and $O + NO_2 \rightarrow NO_3$. Hippler, H.; Schippert, C.; Troe, J. (Ecole Polytechnique Federale, Lausanne, Switzerland). *Int. J. Chem. Kinet.;* **7**: No. Suppl. 1, 27-38(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The photolysis of nitrogen dioxide (4 to 5 torr) at 366 nm and the collisional energy transfer of 18 different inert gases involved in combination reactions of oxygen atoms with nitric oxide and NO_2 were studied. The role of nitric anhydride in the mechanism and corresponding time dependence of the quantum yield was also evaluated. The relative collision efficiencies of each inert gas are tabulated for each reaction and are evaluated in terms of the average energies transferred per collision. A theoretical analysis of the recombination rate constants is also presented.

7342 Reactions of SH with atomic oxygen and hydrogen. Cupitt, L.T.; Glass, G.P. (Rice Univ., Houston, TX). *Int. J. Chem. Kinet.;* **7**: No. Suppl. 1, 39-50(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Several reactions of the SH radical have been studied in a discharge flow system by monitoring the epr spectra that are observed when atomic hydrogen reacts with H_2S in the presence of a large excess of O_2. The behavior of this system is well accounted for by the mechanism: (3) $H + H_2S \rightarrow SH + H_2$; (1) $SH + SH \rightarrow H_2S + S$; (2) $SH + H \rightarrow H_2 + S$; (4) $S + O_2 \rightarrow SO + O$; and (6) $O + SH \rightarrow H + SO$. Rate constants for reactions (2) and (6) have been measured, at 295°K, as $2.5 \pm 0.8 \times 10^{-11}$, and $1.6 \pm 0.5 \times 10^{-10}$ cm^3 $molec^{-1}$ s^{-1}, respectively. Reaction (1) has been found to be unimportant when (H) is much greater than (SH). Yellow wall deposits, that form in the absence of O_2, are completely eliminated when sufficient O_2 is added to the system.

7343 Detailed rate constants for the reactions $H + O_3 \rightarrow OH(v',J') + O_2$, and $H + NO_2 \rightarrow OH(v'',J') + NO$. Polanyi, J.C.; Sloan, J.J. (Univ. of Toronto). *Int. J. Chem. Kinet.;* **7**: No. Suppl. 1, 51-60(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The arrested relaxation variant of the infrared chemiluminescence method was used to obtain information on the initial vibrational, rotational, and spin-state distribution in hydroxyl radical formed during the reaction of atomic hydrogen with ozone. The mean fractions of the total energy (about 79 kcal/mol) entering vibration and rotation in the OH radical were approximately 0.90 and 0.03, respectively. Studies of the reaction of H with nitrogen dioxide to give OH radical and nitric oxide revealed that the mean fractions of total energy (31 kcal/mol) entering vibration and rotation were rough 0.30 to 0.50 and 0.20 to 0.30, respectively. The extent of vibrational excitation was significant and appeared to differ notably from that in the OH product of the reaction involving H and O_3. Experimental evidence points to a rapid vibrational deactivation of OH in collisions with NO_2 without a change in the extent of rotational excitation. The differing vibrational and rotational distributions between H plus O_3 and H plus NO_2 are discussed in terms of possible interaction potentials.

7344 Rate constant measurements for rapid reactions of ground state sulphur 3P⁴(³P/sub j/) atoms. Clyne, M.A.A.; Townsend, L.W. (Queen Mary Coll., London). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 73-84(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The atomic resonance fluorescence technique has been used to directly detect atomic sulphur, S(³P/sub J/), for the first time in a discharge flow system. Using this method, low concentrations of S(³P/sub J/) atoms (1.0×10^{10} cm^{-3} less than or equal to [S] less than or equal to 1.4×10^{12} cm^{-3}) have been measured. The technique has facilitated rate constant measurements, at 298°K, for the bimolecular reactions of S(³P/sub J/) with O_2 (1), and for the first time, for the similar reactions of S(³P/sub J/) with NO_2 (4), O_3 (7), F_2 (10), Cl_2 (11), and Br_2 (12). The results at 298°K were as follows: Rate constants are given over the range 298°K to 511°K. The results of the present work indicate that the S(³P/sub J/) ground state sulphur atom is more reactive than the analogous O(³P/sub J/) ground state oxygen atom.

7345 Thermal structure and dynamics of the stratosphere. London, J. (Univ. of Colorado, Boulder). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 85-99(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Chemical processes related to the thermal structure and dynamics of the stratosphere are discussed. The sink for thermal energy in the stratosphere is mainly through radiative emission by carbon dioxide in the 15 micron bands; thus, its concentration is of considerable interest particularly for the long term stratospheric energy budget. Ozone strongly absorbs near ultraviolet solar radiation and also plays a dominant role in determining the thermal structure of the stratosphere. Ozone variations are largest in the subpolar regions during the winter when the temperature and wind variations in the lower stratosphere are also the largest. There is little water vapor in the stratosphere, although occasional clouds are formed in the middle stratosphere at high altitudes during the winter. Water vapor in the stratosphere is reasonably well mixed, with a mixing ratio of about 4 to 5 ppM (by volume) at 15 km. Additional trace gases in the stratosphere which by themselves exert very little direct input to the radiative budget but either directly or indirectly influence the local concentrations of ozone, water vapor, and/or carbon dioxide include nitric oxide, nitrogen dioxide, atomic hydrogen, hydroxyl radical, and hydroperoxyl radical. The stratosphere also contains a relatively high concentration of aerosols at a height of about 20 km, and stratospheric aerosol is capable of affecting the backscattering of solar radiation by atmospheric particles and thereby changing the overall albedo of the earth-atmosphere system. Aerosols can also contribute slightly to the radiation budget of the lower stratosphere, depending on the refractive index of the aerosol particles.

7346 Rate constant measurements needed to improve a general kinetic mechanism for photochemical smog. Dodge, M.C. (Environmental Protection Agency, Research Triangle Park, NC); Hecht, T.A. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 155-163(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Computer simulation studies were conducted to determine the extent to which uncertainties in rates of reaction influence the predictions of a general kinetic mechanism for photochemical smog. An ad hoc index was formulated to reflect the importance of obtaining more accurate values of rate constants in order to increase the reliability of the mechanism. Based on the rankings of the reactions according to this index, suggestions are offered to kineticists for future research.

7347 Temperature dependence of the rate constants for reactions of ozone with some olefins. Huie, R.E.; Herron, J.T. (National Bureau of Standards, Washington, DC). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 165-181(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The temperature dependence of the rate constants for the reactions of ozone with some olefins has been studied using a stopped-flow reactor in conjunction with a beam sampling mass spectrometer. The effect of molecular oxygen on the measured rate constants was studied, and it was concluded that molecular oxygen scavenges free radical species which could further react with ozone. Rate constants were measured in the presence of molecular oxygen. A good linear correlation is found between the activation energy for the reaction and the ionization potential of the olefin.

7348 Atmospheric reactivity of monoterpene hydrocarbons, NO/sub x/ photooxidation and ozonolysis. Grimsrud, E.P.; Westberg, H.H.; Rasmussen, R.A. (Washington State Univ., Pullman). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 183-195(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The atmospheric reactivity of selected volatile monoterpenes was investigated by measuring their removal as induced by the photolysis of nitrogen oxides and their rates of reaction with ozone in air. Unlike most simpler hydrocarbons generally associated with urban pollution, reaction with ozone appeared to be of primary importance in the atmospheric breakdown of many terpene hydrocarbons. Ozone-monoterpene reactions in the laboratory generally exhibited good second-order rates, with the stoichiometries being dependent on the hydrocarbon type and its relative concentration. Terpenes with endocyclic conjugated diene systems were extraordinarily reactive due to their reaction with ozone. The relative importance of NO/sub x/ photooxidation and ozonolysis in the initial breakdown of several monoterpenes is semiquantitatively described.

7349 Reaction of ozone with 1,3-butadiene and with allene. Toby, F.S.; Toby, S. (Rutgers—The State Univ., New Brunswick). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 197-204(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The reaction of ozone with 1,3-butadiene was studied in the absence and presence of added oxygen, and the reaction of ozone with allene was studied in the presence of oxygen. The temperature range was 0 to 70°C, the initial ozone pressures ranged from 0.01 to 0.1 torr and diene pressures were 0.1 to 5 torr. We found the reaction with 1,3-butadiene to be between one and two orders of magnitude faster than with allene under similar conditions. Added oxygen slowed both reactions and the rate law was found in both cases. Possible mechanisms are discussed in terms of the observed complex dependence of the ozone decay rate in the presence of dienes and the influence of added oxygen on these systems.

7350 Reaction of ozone with hydrogen sulfide and its organic derivatives. Becker, K.H.; Inocencio, M.A.; Schurath, U. (Univ., Bonn). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 205-220(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Chemiluminescent and dark reactions of the aeronomically important trace gases hydrogen sulfide, methyl mercaptan, and dimethyl sulfide with ozone were studied in a flow tube and a low pressure reactor. The maximum of the oxidation rate and of the chemiluminescence intensity in the H_2S/O_3 system under static conditions was preceded by an induction period of up to several minutes. The oxidation rate depended strongly on the ozone concentration but followed no clearly defined rate law. The stoichiometry of ozone versus H_2S consumption was close to unity only at high reaction rates. Trace amounts of nitrogen dioxide quenched the chemiluminescence and also reduced the rate of ozone consumption. More detailed studies in a flow tube revealed that singlet sulfur dioxide chemiluminescence accompanied the reactions of ozone with H_2S as well as its methyl derivatives. Triplet SO_2 was completely quenched at moderate fuel concentrations. A new emission spectrum that was characteristic only of the H_2S/O_3 system was discovered above 5200 A. Meinel bands from vibrationally excited hydroxyl radicals were observed in its place when the methyl derivatives were used as fuels. A reaction mechanism based on sulfhydryl and hydroxyl radicals and a long-lived intermediate was proposed.

7351 Meteorology at ground level. Edinger, J.G. (Univ. of California, Los Angeles). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 221-233(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The meteorological factors which affect the concentration of air pollutants observed at ground level over and downwind of large urban complexes are discussed. They are subdivided into those due to: (1) transport, (2) diffusion, and (3) terrain effects. Examples are given showing how transport (wind) determines the length of time a given air parcel is exposed to the area source. Examples are also presented suggesting how diffusion by the eddying motions of the

turbulent lower atmosphere leads to the progressive dilution of the air parcel with the surrounding atmosphere. It is indicated how terrain influences both wind and eddy diffusion, and how they have their own effect on the concentration of pollutants. Meteorological data requirements for describing the polluted wake from a large area source are described.

7352 Topics in chemical kinetics. Session II. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 235-247(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Topics in chemical kinetics are discussed, with particular reference to the interaction of pollutants in the lower and middle atmosphere. Topics covered include: the production of organic acids as a result of the photooxidation of olefins, models for predicting smog component concentrations, the Los Angeles oxidant control strategy, the effect of nitrogen oxide concentration variation on ozone production, ozone-olefin reactions, hydroxyl radical-olefin reactions, the reliability of rate constant data, discrepancies between ozone calibration procedures for oxidant monitors, reactions of heavy hydrocarbons in flow tubes, and reactions between sulfhydryl radicals and ozone which produce excited species.

7353 Accuracy and precision of gas phase kinetics techniques. Cvetanovic, R.J.; Overend, R.P.; Paraskevopoulos, G. (National Research Council of Canada, Ottawa). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 249-271(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The potential accuracy, precision, and propagation of errors in determinations of gas phase chemical kinetics data are discussed. Methods of treatment of rate data and of the evaluation of the Arrhenius parameters by the least square technique are summarized. The experimental techniques for the determination of the gas phase elementary reactions are classified and their likely sources of error are discussed. For an assessment of the mechanisms of the chemical processes in polluted stratosphere and urban atmosphere the requirements for accuracy vary significantly from reaction to reaction and may be assessed in terms of a particular model by sensitivity tests in computer simulations. The reliability of kinetic data for some of the key atmospheric reactions now substantially exceeds the reliability requirements of atmospheric modeling.

7354 Rate constant ratio for the reactions of OH with O_3 and CO. Demore, W.B. (Jet Propulsion Lab., Pasadena, CA). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 273-287(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Mixtures containing O_2, CO_2, and H_2O were irradiated at 1849 A. Ozone and carbon monoxide were produced, and eventually reached steady-state concentrations. It is shown that the ratio of steady-state concentrations depends only on the relative rates of light absorption by CO_2 and O_2 and the relative rate constants for the OH + CO and OH + O_3 reactions. Experiments in the range 271 to 333°K gave results which yield an Arrhenius expression for the ratio of rate constants for the reaction of OH with $O_3(k_6)$ and $CO(k_7)$.

7355 Reactions of hydroxyl radicals with alkanes. Hucknall, D.J. (City Univ., London); Booth, D.; Sampson, R.J. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 301-316(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

It has been shown that, in aged boric acid-coated reactors at temperatures between 613 and 653°K, the oxidation of alkanes in the presence of decomposing hydrogen peroxide vapour may be interpreted in terms of a simple, nonchain mechanism.

7356 Direct identification of reactive channels in the reactions of hydroxyl radicals with allene, propylene, and 2-butene. Slagle, I.R.; Gilbert, J.R.; Graham, R.E.; Gutman, D. (Illinois Inst. of Tech., Chicago). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 317-328(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Reactive routes of three OH + olefin (C_3H_4, C_3H_6, and C_4H_8) reactions were identified by studying them in high intensity crossed molecular beams. Products were detected and identified using photoionization mass spectrometry. Abstraction of an H atom from the olefin was observed in all three reactions and the free radical product from this route appeared dominant on the mass scans obtained in the OH + C_3H_6 and OH + C_4H_8 reaction. The suggestion is advanced and discussed that the reactions of OH with olefins containing allylic hydrogens proceed primarily by direct H-atom transfer of one of these hydrogens. Evidence that the OH + olefin reactions also proceed by addition was also obtained. The $OH.C_3H_4$ adduct was detected and fragments of the decomposition of the OH.olefin adducts were detected for all three reactions. Information on intramolecular rearrangements in adducts prior to decomposition was obtained by using deuterated reactants. The role of OH + olefin reactions in the photochemical smog cycle is briefly reviewed, and the significance of the results of this study on smog modeling is mentioned.

7357 Reaction NO + HO_2 → NO_2 + OH with OH + H_2O_2 → HO_2 + H_2O as an HO_2-source. Hack, W.; Hoyermann, K.; Wagner, H.G. (Univ., Goettingen, Ger.). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 329-339(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The reaction of nitric oxide with hydroperoxyl radical and the reaction of hydroxyl radical with hydrogen peroxide were studied in an isothermal flow reactor at pressures around 2 torr with helium as the main carrier gas in an effort to investigate the production of HO_2 radicals. The reaction of NO with HO_2 radical led to the production of OH radical and nitrogen dioxide. The reaction of OH with hydrogen peroxide in turn led to the production of HO_2 radicals and water. Rate constants for each reaction are represented in Arrhenius form. The upper limit for the reaction constant involving the reaction of OH with HO_2 to give water plus molecular oxygen is also presented.

7358 Rate measurements of OH by resonance absorption. IV. Reactions of OH with NH_3 and HNO_3. Smith, I.W.M. (Cambridge Univ., Eng.); Zellner, R. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 341-351(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Rate constants have been determined for the reaction OH + NH_3 → H_2O + NH_2 between 228 and 472°K and for OH + HNO_3 → H_2O + NO_3 from 240 to 406°K. In the experiments on the first reaction, OH radicals were created by flash photolysing H_2O; in those on the second reaction approximately 0.1 percent of the HNO_3 was photolysed to produce OH. The subsequent removal of OH was, in both cases, followed by measuring the absorption of OH resonance radiation as a function of time. For first reaction, the results can be expressed in terms of an Arrhenius expression.

7359 Topics in chemical kinetics. Session III. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 353-358(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Topics in chemical kinetics are discussed, with particular emphasis on components that interact in the lower and middle atmosphere. Topics covered include: Uncertainties in Arrhenius expression parameters, the reliability of rate constant data, the selection of reactive channels in hydroxyl radical-olefin reactions for photochemical smog modeling, and the role of abstraction in OH-olefin reactions.

7360 Current status of methods for the estimation of rate parameters. Benson, S.W. (Stanford Research Inst., Menlo Park, CA). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 359-377(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

An analysis of the metathesis reactions of small atoms and radicals is presented in terms of transition state theory. Most current data appear to be compatible with tight transition states in which the making and breaking bonds are not colinear. Many apparent metathesis reactions possess low or zero activation energies and very high A factors (about 10^{10} l/mol/sec), and these reactions are proposed to go through loose transition states resembling those appropriate for radical recombination since they actually do form a stable intermediate. Some anomalously low A factors reported are incompatible with even a tight transition state, and a reexamination of such data is suggested. Addition reactions of atoms and radicals also appear to fall into the same tight or loose transition state classes. Ion-pair (electron-donor) complexes are hypothesized as being formed and in turn stabilizing those atom and radical acceptors with high electron affinity and those donors with low ionization potentials. A recombination involving atomic oxygen and nitric oxide is explained in terms of a rotational NO—O complex in which the O atoms are nonequivalent and which can be quenched to nitrogen dioxide. Reactions involving chlorine atom and NO are similar, while the reaction of atomic oxygen with molecular oxygen goes via a tight complex. Some anomalously high activation energies for exothermic metathesis of carbon monoxide with O_2 and NO_2 are understandable when proper account is taken of the high endothermicity for the addition step.

7361 Photolysis of gaseous nitrous acid: a technique for obtaining kinetic data on atmospheric photooxidation reactions. Cox, R.A. (Atomic Energy Research Establishment, Harwell, Eng.). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 379-398(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The photolysis of gaseous nitrous acid in nitrogen/oxygen mixtures at 760 torr pressure was investigated. The major reaction occurring during absorption by HONO in the near ultraviolet was

the dissociation of the acid into hydroxyl radicals and nitric oxide. Nitrous acid photolysis provides a useful source of OH radicals for kinetic studies under conditions similar to those prevailing in the lower atmosphere. With the addition of a large excess of carbon monoxide, the photolysis can also provide a source of hydroperoxyl radicals. Reaction rate constants at 300°K and 1 atmosphere pressure are given for the photolysis of HONO after the addition of CO, sulfur dioxide, and some simple olefins.

7362 Estimation of rate constants as a function of temperature for reactions X + YZ reversible XY + Z, X + Y + M reversible XY + M, and X + YZ + M reversible XYZ + M, where X, Y, and Z are atoms, H, N, O. Benson, S.W.; Golden, D.M.; Lawrence, R.W.; Shaw, R.; Woolfolk, R.W. (Stanford Research Inst., Menlo Park, CA). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 399-440(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

A mathematical expression for rate constants of transfer reactions involving atomic and molecular hydrogen, nitrogen, and oxygen, nitric oxide, hydroxyl radicals, and HN radical is derived to provide a computer program for estimating rate constants of elementary chemical reactions for mathematical models of combustion processes. A table of rate constants for such reactions is listed which may prove useful in estimating other rate constants for reactions that have not been experimentally studied, especially for temperatures above 1000°K. A convenient form of the equilibrium constant that is suitable for combustion reactions is also given.

7363 Thermochemical and kinetic studies of alkyl nitrites (RONO)—D(RO-NO), the reactions between RO and NO, and the decomposition of RO. Batt, L.; McCulloch, R.D.; Milne, R.T. (Univ. of Aberdeen, Scotland). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 441-46!(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Thermodynamic and kinetic studies of the alkyl nitrite bond breakage into the alkoxy radical and nitric oxide in the gas phase were conducted with a conventional static system over a temperature range of 120 to 200°C. Apparent disagreement between previous kinetic and thermodynamic data for the dissociation of alkyl nitrites was resolved in terms of effects of two parallel reactions; a homogeneous radical split and either a homogeneous or a heterogeneous molecular elimination process. The rate coefficients for the combination and disproportionation of RO and NO were confirmed, with both showing zero activation energy. The activation energy associated with the alkyl nitrite bond breakage was calculated as 41.5 +- 1 kcal/mol.

7364 High temperature oxidation of methyl mercaptan (shock waves). Matsuda, S.; Bauer, S.H. (Cornell Univ., Ithaca, NY). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 463-475(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The oxidation of methyl mercaptan was studied via the single pulse shock tube technique. Mixtures of CH_3SH and O_2, highly diluted in Ar, were shock heated to temperatures between 1100 and 1850°K to a total density of 2.5×10^{-5} mol/cm³ for a duration of about 450 μs. Oxygen-rich mixtures (2 percent CH_3SH + 6.5 percent O_2) showed characteristics of a chain branching reaction; after an induction period a rapid pressure rise occurred indicative of an explosion. The product analysis showed complete combustion to H_2O, CO_2, and SO_2. In contrast, oxygen-lean mixtures (2 percent CH_3SH + 3.6 percent O_2 and 2 percent CH_3SH + 2 percent O_2) did not clearly indicate a chain branching process or an explosion. The major carbon bearing species in the O_2-lean mixtures at low temperatures, less than 1800°K, was methane. This indicates that CH_3 radicals formed in the initial reaction: $CH_3SH \rightarrow CH_3 + SH$, attack the SH group in the methyl mercaptan much faster than the methyl radicals react with oxygen at these temperatures. From the data obtained in these experiments it is possible to compare rate constants for the various reactions. While this initial study of the high temperature oxidation of CH_3SH does provide information on several early steps in the combustion, many gaps remain in the formulation of an operational mechanism. However, inspection of the tables shows that there is little hope in minimizing the production of SO_2 under conditions which maximize the extent of combustion. In these experiments SO_2 is produced even more readily than CO.

7365 Reactions of n-butyl radicals with molecular oxygen at low temperatures (ambient → 200°C). Currie, J.L.; Sidebottom, H.W.; Tedder, J.M. (Univ. of St. Andrews, Scotland). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 477-491(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The photolysis of azobutane in an oxygen atmosphere at 60°C yields n-butyraldehyde and n-butanol as the principal products, but even at this low temperature fragmentation products are present. The major products are formed through radical-radical reactions and chain processes are quite unimportant at this temperature. In order to account for the products and their relative proportions the possible involvement of cyclic trioxy and tetroxy transition states is discussed.

7366 Photostationary state in photochemical smog. Stedman, D.H. (Univ. of Michigan, Ann Arbor); Jackson, J.O. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 493-501(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

A photostationary state equation for the photolysis of nitrogen dioxide by ultraviolet light was tested with ambient air measurements obtained in downtown Detroit in the summer of 1973. The equation stated that the concentration of NO_2 times the rate constant for the dissociation of NO_2 into nitric oxide and atomic oxygen can be divided by the rate constant for the reaction of NO with ozone (which produces NO_2 and O_2) times the concentrations of ozone and NO to yield a numerical value of 1. An experimental value of 1.01 was obtained during actual smog conditions from 400 data sets with a standard deviation of 0.2 and a standard error of 0.01, representing a verification of the equation.

7367 Topics in chemical kinetics. Session IV. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 503-508(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Topics in chemical kinetics are discussed, with particular reference to the interaction of pollutants in the lower and middle atmosphere. Topics covered include: problems involved with transition state theory and modifications of it, chemical bond making and breaking, the non-Arrhenius behavior of rate constants over a given temperature range, the effect of sulfur dioxide addition to a smog system (hydrocarbons, nitrogen oxides, and air) on ozone production, the reaction between hydroxyl radical and SO_2, the role of excited nitrogen dioxide states in the achievement of the photostationary state, the reaction of NO_2 with O_3, correlations between changes in source functions such as rush hour traffic peaks with variations from unity in the photostationary state ratio, and the significance of ammonia oxidation in terms of tropospheric and stratospheric chemistry.

7368 Atmospheric aerosol formation by chemical reactions. Hidy, G.M. (California Inst. of Tech., Pasadena); Burton, C.S. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 509-541(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

This paper is a review of several aspects of aerosol formation processes that occur in the earth's atmosphere. Important contributors to atmospheric aerosol chemistry are the sulfates, nitrates, and organic compounds, which are considered to be formed mainly by reactions of trace reactive gases in air. The phenomenology of the evolution of aerosols by such chemical processes is illustrated by recent observations taken in Los Angeles smog. The results of this program show the strong relationships between sulfate, nitrate, and organic carbon formation and gas phase processes of photochemical smog. Suspected mechanisms of secondary aerosol production are summarized, with consideration for both homogeneous and heterogeneous processes. These mechanisms are examined in the light of laboratory simulations and the knowledge of atmospheric behavior to deduce the potential importance of certain classes of reactions for explaining aerosol evolution. Such considerations illustrate well the complexities of gas-particle interactions in atmospheric chemistry.

7369 Atmospheric gas phase oxidation mechanisms for the molecule SO_2. Davis, D.D.; Klauber, G. (Univ. of Maryland, College Park). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 543-556(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

This paper presents a review of what is currently known about homogeneous gas phase oxidation processes which might be involved in the atmospheric conversion of SO_2 to H_2SO_4 and aerosol. Considered in the text are nine possible initiating steps whose rate constants, when combined with model calculated concentration data, suggest that in both the unperturbed troposphere and stratosphere the most important initiating step is the reaction of hydroxyl free radicals with SO_2. Also presented in the text are the results from a recent aircraft sampling study of trace gases in power plant plumes. These results strongly suggest the importance of gas phase free radical chemistry (for conversion of SO_2 to H_2SO_4) during summertime conditions.

7370 Condensation nucleus size analyzer suitable for studying the kinetics of aerosol formation. Schmidt, K.H. (Argonne National Lab., IL). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 557-565(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

An instrument for determining the number and size distribution of condensation nuclei from 1 to 20 nm radius is described. It works on the cloud chamber principle. The humidified gas mixture to be analyzed undergoes an adiabatic expansion of about 2 s. The

fog droplet formation during this time is followed by repetitively scanning a small volume illuminated by a pulsed ion laser, with a highly sensitive TV camera connected to electronic counting circuitry. From the number of appearing fog droplets and the pressure drop as a function of time, the distribution of the number concentration vs. the critical radius is computer-calculated.

7371 Kinetics of homogeneous particle nucleation and growth. Heicklen, J. (Pennsylvania State Univ., University Park); Luria, M. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 567-580(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The kinetics of homogeneous particle nucleation and growth are reviewed for systems in which nucleation rate data are available. Systems considered include: water vapor condensation, metal oxide production, photoexcitation of sulfur dioxide-hydrocarbon systems, ammonium nitrate production from the reaction of ammonia and nitric acid, and ammonium chloride production from the reaction of ammonia with hydrogen chloride. The kinetic data for nucleation associated with each of these systems can be fitted to a simple equilibrium theory expression that states the nucleation rate is equal to the nucleation rate coefficient multiplied times the concentration of the nucleating species to the q plus 1 power, where q is the critical cluster size required for nucleation to proceed. A q plus 1 value of 38 fits the data for water vapor at -5 C, while for other systems q is very much smaller. For example, the q plus 1 values for photoexcited SO_2-acetylene and SO_2-allene systems at room temperature are 3.6 and 6.7, respectively. Data for metal oxide formation is very limited. Dissociation appears to be complete in the vapor phase for the NH_4NO_3 system; while data is more limited for the NH_3-HCl system, it may be dissociated in the vapor phase also.

7372 Influence of aerosols on the chemistry of the troposphere. Graedel, T.E.; Farrow, L.A.; Weber, T.A. (Bell Labs., Murray Hill, NJ). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 581-594(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Full kinetic calculations of the diurnal chemistry of the urban troposphere have been made using a formalism that includes the interactive effects of aerosols and free radicals. Duplicate calculations made without the aerosol interaction terms are shown to be less successful in reproducing air quality data than is the complete calculation. The differences between the two computations come about because the concentrations of radicals are reduced by aerosol removal, with resulting decreases in the rates of radical reactions with the chemically important NO—NO_2—O_3 triad. The aerosol sink rates for HO_2 and CH_3O_2 are compared with chemical reaction rates, and shown to be nearly equal to the calculated difference between chemical source and sink terms. (Meteorological effects on free radical concentrations are found to be negligible.) Aerosols thus appear to provide a vital stabilizing influence on the free radical chemistry of the troposphere.

7373 Heterogeneous reactions of OH radicals. Mulcahy, M.F.R.; Young, B.C. (CSIRO, N.S.W., Australia). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 595-609(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The nature and kinetics of reactions of hydroxyl radicals at the surfaces of graphite or pyrex glass treated with aqueous orthophosphoric acid were studied in a flow system at 298°K by mass spectrometric analysis of the reaction products. The OH radicals were generated in the presence of excess hydrogen atoms by the reaction of atomic hydrogen with nitrogen dioxide to give OH radicals and nitric oxide. The main reaction by which OH radical was destroyed at either surface appeared to be the reaction of H with OH to yield water. On the graphite surface, OH radicals also reacted with the substrate to produce approximately equal amounts of gaseous carbon monoxide and carbon dioxide, with the combined rate of OH consumption by these reactions being about ⅓ that for the reaction of OH with H. The collision efficiency for the loss of OH was about 0.01 for the treated pyrex and greater than 0.05 for the graphite surface. The results suggest that the rate of destruction of OH at the surface of aerosol particles in urban air is unlikely ever to approach the rate at which OH reacts with gaseous pollutants present. Also the lifetime of soot particles in the presence of the currently estimated concentration of OH in the lower troposphere is likely to be between 5 mo and 5 yr.

7374 Photoreaction of sulfur dioxide with hydrocarbons. II. Chemical and physical aspects of the formation of aerosols with butane. Penzhorn, R.D.; Filby, W.G.; Guenther, K.; Stieglitz, L. (Kernforschungszentrum, Karlsruhe, Ger.). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 611-627(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The aerosol products from the photoreaction of sulfur dioxide with short-chain alkanes, particularly butane, were investigated with combined gas chromatography-mass spectrometry. The reaction of triplet SO_2 with alkanes involved a proton abstraction as the primary step rather than an insertion and/or a dissociative collision. Triplet SO_2 attacked carbon-hydrogen bonds specifically, resembling simple free radicals and atoms in this respect. Subsequent reactions were governed by the ease of formation and stability of the alkyl sulfonyl radicals which tended to disproportionate rather than recombine or abstract protons. The RSO_2 radicals gave rise to sulfonic acid and thiosulfonate via reactions involving the hydrosulfonyl radical. Some derived rate constant ratios are presented along with proposed reaction mechanisms.

7375 Kinetics of association reactions pertaining to H_2SO_4 aerosol formation. Castleman, A.W. Jr.; Davis, R.E.; Munkelwitz, H.R.; Tang, I.N.; Wood, W.P. (Brookhaven National Lab., Upton, NY). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 629-640(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

The rates of oxidation of SO_2 by OH were measured at room temperature by performing steady-state photolysis of mixtures of H_2O, SO_2, and CO in N_2. At a total pressure of 760 torr, the pseudo-second-order rate constant is 6.0×10^{-13} cm^3 $molec^{-1}$ s^{-1}. With nitrogen as the third body, and at pressures less than 20 torr, the third-order rate constant was found to be 1.6×10^{-13} cm^6 $molec^{-2}$ s^{-1}. Separate experiments, employing fast-flow techniques, were conducted to determine the rate of reaction of SO_3 with H_2O. At room temperature and total pressures ranging from 1.0 to 1.3 torr, a value of 9.1×10^{-13} cm^3 $molec^{-1}$ s^{-1} was obtained. These measured rate constants, along with the requisite atmospheric concentration data currently available in the literature, were used to assess the possibility of gas phase conversion of SO_2 to sulfuric acid aerosols. It was concluded that under some conditions new aerosols could form in both the troposphere and the stratosphere.

7376 Topics in chemical kinetics. Session V. *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 641-652(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Conference participants discussed various topics in chemical kinetics relating to atmospheric interaction of air pollutants in the lower and middle atmospheres. (PCS)

7377 Reaction of the OH($X^2\Pi$) radical produced by the pulse radiolysis of water vapor. Gordon, S.; Mulac, W.A. (Argonne National Lab., IL). *Int. J. Chem. Kinet.;* 7: No. Suppl. 1, 289-299(1975).

From Symposium on chemical kinetics data for the upper and lower atmosphere; Warrenton, VA, USA (15 Sep 1974).

Hydroxyl radicals were produced by pulse radiolysis of pure water vapor, water vapor containing OH scavengers, and mixtures of water vapor with argon and OH scavengers. The OH radical was detected in its ground state by its optical absorption at 3087 A. Its reaction with various compounds added to the water vapor was measured by following the change in absorption of the OH radical with time. Rate constants were determined for reactions of the OH radical with ammonia, nitrous oxide, nitric oxide, nitrogen oxide, sulfur dioxide, carbon monoxide, and various hydrocarbons at temperatures ranging from 298 to 440°K and pressures of water vapor ranging from 10 to 760 torr. The rate constant for the second-order disappearance of the OH radical in pure water vapor was also determined.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 5794, 5842, 5843, 5877, 6110, 6424, 6432, 6872, 6873, 7130, 7144, 7168, 7367, 7567, 7568, 7569, 7588

7378 (AI—77-14) Atomics International environmental monitoring and facility effluent annual report, 1976. Moore, J.D. (Atomics International Div., Canoga Park, Calif. (USA)). 1977. 46p. International Div., Canoga Park, CA.

Environmental and facility effluent radioactivity monitoring at Atomics International (AI) is performend by the Radiation and Nuclear Safety Unit of the Health, Safety, and Radiation Services Department. Soil, vegetation, and surface water are routinely sampled to a distance of 10 miles from AI sites. Continuous ambient air sampling and thermoluminescent dosimetry are performed on site for monitoring airborne radioactivity and site ambient radiation levels. Radioactivity in effluents discharged to the atmosphere from AI facilities is continuously sampled and monitored to ensure that levels released to unrestricted areas are within appropriate limits, and to identify processes which may require additional engineering safeguards to minimize radioactivity levels in such effluents. In addition, selected nonradioactive constituents in surface water discharged to unrestricted areas are determined. This report summarizes and discusses monitoring results for 1976. The results of a special soil plutonium survey performed during the year are also summarized.

7379 (EPRI-EA—419-SY) **Sulfur and biological systems. Summary report of a workshop at Missouri Botanical Garden, May 30—31, 1975.** Bland, M.K. (NUS Corp., Menlo Park, Calif. (USA)). May 1977. 30p. Dep. NTIS, PC A03/MF A01.

Results of a workshop on Sulfur and Biological Systems, cosponsored by EPRI and Union Electric, are presented. Discussed are: the sulfur cycling processes occurring in atmospheric, aquatic, and terrestrial ecosystems, and the ecological effects of introducing man-originated sulfur compounds into the environment. In most environments, a continuous flux of sulfur occurs through microbial cycles without significant accumulation of toxic sulfur compounds. However, increased anthropogenic sulfur emissions have resulted in noticeable effects on both aquatic and terrestrial biota. Substantial losses of fisheries have been attributed to lake acidification. Sulfur effects on plants range from being stimulatory (as a nutrient) to causing acute mortality at high concentration levels.

7380 (ERDA—77-64, pp 23-37) **Environmental transport.** Crawford, T.V.; Connor, J.J.; Cushing, C.E. Jr. Jun 1977.

In Effects of trace contaminants from coal combustion.

Before the effects of coal-derived trace contaminants on man and ecosystems can be evaluated, it is necessary to estimate the transport, transformation, and bioaccumulation of these contaminants as they move from the power plant to the receptor. In addition to determining routes of transport and transformation, rates for these processes also must be determined before we can predict environmental fate and levels of exposure. Information on the physical and chemical characteristics (e.g., particle size, solubility, and valence state) of materials released to the environment is a vital prerequisite to study of transport processes. This panel considered transport phenomena associated with particulate and gaseous emissions to the atmosphere and with disposal of sludge, fly ash, bottom ash, and scrubber liquors to ash basins and landfills. Discussions focused on environmental transport processes which would apply to several general classes of trace contaminants rather than to specific trace contaminants. A recent assessment of the environmental effects of trace metals from coal combustion was used as a framework for some of the discussions. However, it was recognized that a more complete environmental assessment must be carried out in order to complete the evaluation of environmental effects of coal-derived contaminants.

7381 (LF—56, pp 44-49) **Microscopic characterization of fly ash.** Clark, R.; Carpenter, R.L. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Several methods of analyzing and characterizing fly ash from coal-fired power plants have been investigated. These include optical and scanning electron microscopy. Three basically different types of particles could be identified by microscopy. These were partially-fused rock particles mixed with carbon (coal or soot), hollow spheres, and solid spheres. The type of particles observed varied with the sample origin. Cenospheres and plerospheres were observed in some samples, as reported by others. Studies of the conditions resulting in the formation of hollow aerosol particles, the formation of glass and ceramic spheres from melted refractory metal oxides and the properties of burning zirconium metal in free-fall combine to suggest mechanisms by which the observed fly ash particles may be formed.

7382 (LF—56, pp 50-55) **Fly ash solubility studies.** Hanson, R.L.; Carpenter, R.L.; Henderson, T.R. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

The solubility of fly ash from coal-fired power plants was studied using concentrated nitric acid, 0.1 N hydrochloric acid, and dimethyl sulfoxides. The results indicate the diversity in the relative solubility of many elements for the different samples. Many elements show solubility in dimethyl sulfoxide which is a complexing agent for cations.

7383 (LF—56, pp 56-60) **Development of a five-stage, round jet, virtual cascade impactor.** Talley, D.; Newton, G.J.; Yeh, H.C. Waligora, S.J. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Conventional cascade impactors are of limited usefullness as source samplers because momentarily high particle concentrations in stacks can cause rapid sample buildup leading to particle re-entrainment and subsequent size analysis errors. To prevent excessive buildup of deposited aerosols, sample times must be so short that samples are not representative of aerosols present in stacks over extended times. In addition, sticky substrate collection surfaces must usually be avoided because of elevated temperatures within stacks. This leads to increased particle bounce within the impactor and additional size analysis errors. Virtual cascade impactors eliminate problems of particle bounce and re-entrainment. A prototype five-stage, round jet, virtual cascade impactor operating in the range of 15 to 25 standard liters per minute has been built. The device will pass through standard sampling ports. The sharpness of cutoff for each stage is limited by the requirement for positive flow of a fraction of sampled aerosol into each collector. Sample sizes are limited by buildup which causes excessive pressure drops across collector filters and altered fractional flow through collectors; however, the range of acceptable pressure drops is broad.

7384 (NP—21967, pp 163-183) **Anti-pollution patenting.** Mar 1977.

In Technology assessment and forecast: seventh report.

A description is given of a collection of antipollution patents. The patents cover a wide range of utilities--from waste disposal to exhaust emission control to oil spill recovery. By individual patent review, the list was subdivided into sixteen broad technological groupings as follows: (1) non-polluting exhaust emission, other than automotive; (2) purification of automotive exhaust emissions; (3) disposing, decontaminating and recycling of household and industrial waste; (4) water purification techniques; (5) noise reduction devices; (6) oil control, containment and extraction systems; (7) smoke and fire detection devices; (8) control analylzers, sensors and detectors; and (9) process for the treatment and recovery of chemical waste.

7385 (PB—265127(Pt.2)) **Inventory of energy research and development: 1973—1975. Volume III. Serial U.** (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-ENG-26. vp. (NSF/RA—760495(Pt.2)). PC E99.

Brief summaries are presented of USA research studies during 1973 through 1975 on the effects of energy sources on the environment and public health. Effects of chemical and radioactive effluents, air pollution, water pollution, and toxic materials on aquatic and terrestrial ecosystems; biological effects of radiation, with emphasis on internal irradiation; and the biological effects of ingested or inhaled toxic materials are covered.

7386 **Loss of beryllium from aqueous solution during storage.** Gladney, E.S.; Goode, W.E. (Los Alamos Scientific Lab., NM). *Anal. Lett.;* **10**: No. 7/8, 619-623(1977).

To investigate the potentiality for Be mobilization within the atmosphere, the behavior of Be in solution during long term storage at low concentrations was studied. Be solutions in water and in 0.1 and 1.0% solutions of HCl, HNO_3, H_2SO_4, and HF were stored in polypropylene, teflon, polycarbonate, polyvinylchloride, linear polyethylene, and glass containers. On the basis of selected optimum conditions, polycarbonate is the best container and 0.1% HCl, H_2SO_4, HF or 1.0% H_2SO_4 are the best preservatives. (BLM)

7387 (UCRL—78627(Rev.1)) **Ozone destruction by catalysis: credibility of the threat.** Ellsaesser, H.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 May 1977. Contract W-7405-ENG-48. 21p. (CONF-761229—3). Dep. NTIS, PC A02/MF A01.

From Fall meeting of the American Geophysical Union; San Francisco, California, United States of America (USA) (6 Dec 1976).

In an effort to assess the credibility of predictions concerning the O_3 layer and to pinpoint avenues for improving current stratospheric models, a review was undertaken of observational data believed to have a bearing on the validity of destruction of stratospheric O_3 by catalysis. Aside from short period responses of O_3 above 20 km to PCA's and changes in solar flux, no data were found to confirm catalytic destruction both qualitatively and quantitatively. Predicted changes following such perturbations as nuclear tests, solar cycle modulation of cosmic rays, PCA's and volcanic eruptions cannot be clearly identified in the total O_3 observations. Observed variations in total O_3 appear to have been controlled by processes not included in current stratospheric models. As a minimum, it is concluded that predictions regarding stratospheric O_3 do not, at present, warrant the confidence implied by CIAP.

7388 **Pollution safety, and disaster prevention.** Ando, H.; Ouchi, H.; Shirodo, N.; Shiota, K.; Tamori, Y.; Tsuchimoto, K.; Nakamura, E.; Hanada, K.; Hirazawa, S.; Hirano, N. *Int. Chem. Eng.;* **17**: No. 3, 443-467(Jul 1977).

Translated from Sekiyu Gakkaishi; 18: No. 6, 513-527(1975).

The literature on pollution, safety, and disaster prevention mainly for 1974 is reviewed, and the references are listed. The article covers the present status of atmospheric pollution and atmospheric pollution standards from the atmospheric pollution related field, pollution prevention technology, water pollution, waste treatment and management, marine pollution, and safety and disaster prevention.

7389 **Dispersion of particulate arsenic waste from the chimney of Giant Yellowknife Gold Mines Ltd.** Smith, R.A. (Univ. of Alberta, Edmonton). *Sci. Total Environ.;* 7: No. 3, 227-233(May 1977).

Measured ground level concentrations of airborne arsenic trioxide within 8 km of the smelter stack of Giant Yellowknife Gold Mines Ltd., near Yellowknife, N.W.T., Canada, are found to decrease monotonically as a function of distance from the source. This

departure from the normal pattern of maximum ground level concentration of gaseous pollutant several kilometers from the source is explained in terms of the condensation of arsenic trioxide to give particles up to fifty microns in diameter. These particles settle rapidly to the ground shortly after their formation in or immediately above the stack.

7390 Distribution of some hydrocarbons in ambient air near Delft and the influence on the formation of secondary air pollutants. Bos, R.; Guicherit, R.; Hoogeveen, A. (TNO Research Institute for Environmental Hygiene, Delft, Netherlands). *Sci. Total Environ.;* **7**: No. 3, 269-281(May 1977).

The relative concentrations of hydrocarbons in the atmosphere may provide information concerning their origin. It appears that the hydrocarbon composition measured in Delft (The Netherlands) is entirely different for northern and southern wind directions. This points to different sources. The most important sources for this area are natural gas leaks, traffic, and (petrochemical) industries. It appears that the relative potential of the precursor mix to form peroxyacetylnitrate (PAN) and ozone is also different for both wind directions.

7391 Performance characteristics of the 10 mm respirable mass sampler. II. Coal dust studies. Caplan, K.J. (Univ. of Minnesota, Minneapolis); Doemeny, L.J.; Sorenson, S.D. *Am. Ind. Hyg. Assoc. J.;* **38**: No. 4, 162-173(Apr 1977).

The 10 mm cyclone respirable mass sampler was evaluated to determine the flow rate which best matched the British Medical Research Council and the Los Alamos Atomic Energy Commission-American Conference of Governmental Industrial Hygienists criteria, and to determine effects of pulsating flow, particle charge, mass loading, and sampler orientation. The work with coal dust is presented. There is no significant difference between results obtained, for normal ranges of airborne dust concentration and size distribution, due to particle charge, sampler orientation or position (except upside down, which was not investigated), dust concentration, and ambient air velocity.

7392 Health effects of exposure to automobile exhaust. V. Exposure of toll booth operators to automobile exhaust. Burgess, W.A.; Diberardinis, L.; Speizer, F.E. (Harvard School of Public Health, MA). *Am. Ind. Hyg. Assoc. J.;* **38**: No. 4, 184-191(Apr 1977).

The exposures of automobile toll booth collectors in the Boston area to selected air contaminants were monitored during the four seasons from 1972 to 1974. The highest carbon monoxide concentrations were found at the in-city toll booths and the highest lead levels at the suburban booths. Biological monitoring for carbon monoxide and lead exposure were closely related to airborne contaminant levels. The study supports the need for environmental control for toll booths located at busy highway and tunnels.

7393 SO_4:Cl ratio in oceanic rainwater. Kroopnick, P. (Univ. of Hawaii, Honolulu). *Pac. Sci.;* **31**: No. 1, 91-106(Jan 1977).

Rainwater samples collected on 20 islands in the Pacific and Atlantic oceans since 1961 have been analyzed for dissolved sulfate and chloride ion concentrations. Samples from sparsely populated islands have SO_4:Cl ratios approximately equal to that observed in seawater. Notable exceptions are samples from Midway and Christmas islands, which are enriched in sulfate, and those from the ocean stations Echo, Papa, and Victor, which are depleted in sulfate. The variation ^{18}O of the oxygen in the SO_4 ion ranges from 9.5‰ in seawater and unpolluted rain to 11.2‰ in rain derived from continental air mass. Aerosols and snow samples have higher variation ^{18}O values of 11.2 to 14.8‰ due to their greater efficiency in trapping locally produced sulfate pollutants.

7394 Urban formaldehyde: observed correlation with source emissions and photochemistry. Cleveland, W.S.; Graedel, T.E.; Kleiner, B. (Bell Labs., Murray Hill, NJ). *Atmos. Environ.;* **11**: No. 4, 357-360(1977).

Statistical analyses of formaldehyde data from four sites in New Jersey show the effects on formaldehyde concentrations of automobile traffic and photochemical formation. Integrated formaldehyde concentration during the hours 05:00 to 20:00 decrease from workdays to Saturdays to Sundays corresponding to a reduction in motor vehicle traffic. On workdays the formaldehyde concentrations are higher on days with more photochemical activity. As with ozone, formaldehyde shows a yearly variation in which concentrations are considerably higher in summer than in winter. The peak formaldehyde concentrations (as measured by the upper decile of 1-h daily maxima) at the four sites are in the range 14 to 20 ppb.

7395 Improved thin-film sulfate test for submicron particles. Ayers, G.P. (CSIRO). *Atmos. Environ.;* **11**: No. 4, 391-395(1977).

Details are given of improvements to the vapor-deposited thin-film method of testing submicron particulates for sulfate. The test is shown to be useful for sulfates having a solubility greater than approximately 10^{-1} M dm^{-3} at 20°C. With the exception of bisulfate and peroxydisulfate common soluble oxy-anions of carbon, nitrogen, phosphorous and sulfur do not cause interference.

7396 Distant source sensing by statistical treatment of air quality data. Graedel, T.E. (Bell Labs., Murray Hill, NJ). *Atmos. Environ.;* **11**: No. 4, 313-319(1977).

The normalized concentration rose and the concentration boxplot are introduced and applied to data on hydrogen sulfide concentrations and horizontal wind flow at a site near several sources of H_2S. The techniques are shown to be effective for remote identification and semiquantitative estimation of both sporadic and continuous sources and of their relative emission rates, utilizing only data that are commonly available from air quality monitoring stations.

7397 Sulfur dioxide-sulfate relationships in Budapest. Meszaros, E. (Institute for Atmospheric Physics, Budapest); Moore, D.J.; Lodge, J.P. Jr. *Atmos. Environ.;* **11**: No. 4, 345-349(1977).

Sulfur dioxide and sulfate ion concentrations, measured in a suburban area near Budapest, and previously used in a general study of correlations among aerometric parameters (Meszaros, 1973), are used to derive estimates of activation energy and rate of sulfur dioxide-to-sulfate conversion. Two different analyses are made, one based upon purely meteorological considerations, and the other on the grouping of data. The first yields an estimate of the half-life of sulfur dioxide of approximately 2 h, and the other of 10 h. The corresponding activation energies are respectively 23 and 9 kcal $mole^{-1}$. Both treatments lead to statistically significant correlation coefficients. However, the scatter of data and the small number of points prevent a clear decision between the alternatives. It appears that the method is valid, but that far more data are needed before a decision can be made concerning the true values of the key kinetic constants.

7398 Sulfur dioxide oxidation over atmospheric aerosol: x-ray photoelectron spectra of sulfur dioxide adsorbed on V_2O_5 and carbon. Barbaray, B.; Contour, J.P.; Mouvier, G. (Univ., Paris). *Atmos. Environ.;* **11**: No. 4, 351-356(1977).

Adsorption and oxidation of sulfur dioxide over V_2O_5 and carbon are studied by x-Ray Photoelectron Spectroscopy (XPS). SO_2 does not chemisorb onto V_2O_5 below 150°C, and it oxidizes at 200°C into adsorbed sulfate and sulfur trioxide. Over carbon chemisorption and oxidation occur from room temperature upwards but at 200°C reduction of SO_2 by carbon also takes place, giving elementary sulfur and carbon disulfude. From these results, it is concluded that the V_2O_5 aerosols contribute little to the production of atmospheric sulfuric acid below 150°C, whereas carbon particles can catalyse SO_2 oxidation even at low temperatures, and produce at higher temperature secondary adsorbed pollutants such as elementary sulfur and carbon disulfide.

7399 Evaluation of outdoor air quality in rural and urban communities. Hosein, H.R.; Mitchell, C.A.; Bouhuys, A. *Arch. Environ. Health;* **32**: No. 1, 4-13(1977).

A year-round air monitoring program for sulfur dioxide, sulfates, nitrogen dioxide, nitrates, ozone, and total suspended particulates was conducted in three towns with population densities ranging from 29/km^2 to 1178/km^2. The results showed significant differences in concentrations of several pollutants between the urban town and the two rural towns. However, site-to-site variation over distances of 1 mile or less within the urban area was considerable. To express pollutants loads in each town in a single number, calculations were made on a combined pollutant index on premises similar to those used for combined occupational exposures, but with U.S. primary air quality standards rather than threshold limit values as indices of minimal health effects. The combined index exceeded unity in all three towns, suggesting either that total pollutant loads may be excessive even in the sparsely populated town of Lebanon, Connecticut, or, more likely, that the U.S. primary air quality standards have been set at low levels without due regard for additive effects.

7400 Daily variation in air quality. Hosein, H.R.; Mitchell, C.A.; Bouhuys, A. *Arch. Environ. Health;* **32**: No. 1, 14-21(1977).

We related year-round air pollutant concentrations in three small U.S. towns, with considerable differences in population density and industrial activity, to air temperature, wind direction, wind speed, rainfall, sky conditions, and days of the week (workdays vs. weekends). Much of the day-to-day variations in air pollutant (sulfur dioxide, sulfates, nitrogen dioxide, nitrates, ozone, total suspended particulates) concentrations can be explained by changes in weather conditions. During weekends, pollution did not decrease consistently and, in some instances, may have increased as a result of dense recreational traffic. We suggest that recognition of the multifactorial causatior. of high levels of air pollution may lead to more realistic, more effective, and less costly air pollution control programs.

7401 Determination of atmospheric NO after recovery on dry film base. Bourbon, P.; Alary, J.; Esclassan, J.; Lepert, J.C.

(INSERM, Toulouse). *Atmos. Environ.;* **11**: No. 5, 485-488(1977). (In French).

The authors propose a method of collection and simultaneous determination of NO and NO_2 on filters impregnated with triethanolamine. The colorimetric determination of NO and NO_2 uses a modified Saltzman's reagent. NO is oxidized to NO_2 using O_3. The conditions of this oxidation are presented. The technique proposed for the measurements in the environment gives comparative results to those obtained with Chemiluminescence.

7402 Discrepancy between background atmospheric ammonia gas measurements and the existence of acid sulfates as a dominant atmospheric aerosol. Lau, N.C.; Charlson, R.J. (Univ. of Washington, Seattle). *Atmos. Environ.;* **11**: No. 5, 475-478(1977).

From the knowledge of NH_4^+ and H^+ concentrations in precipitation (during rainy periods) and aerosol particles (when it is not raining) over the continental United States and in ocean water along the coasts, the atmospheric NH_3 gas concentration can be inferred by assuming Henry's law equilibrium. It is found that this method gives NH_3 concentrations which are in some cases considerably lower than those obtained through direct measurements. NH_3 is thus estimated to vary geographically and temporally with the midwest region being a dominant source of this trace gas. Oceanic areas exhibit much lower concentrations. These findings are consistent with the existence of acid sulfates as a dominant atmospheric aerosol, with soil chemistry and with previous investigations concerning the association of the molecular forms of sulfate aerosols with air mass history.

7403 Simplification of a Gaussian puff model for real-time minicomputer use. Ludwig, F.L.; Gasiorek, L.S.; Ruff, R.E. (Stanford Research Inst., Menlo Park, CA). *Atmos. Environ.;* **11**: No. 5, 431-436(1977).

Simplifications are described that will substantially reduce the computation time and memory requirements of a Gaussian puff diffusion model without impairing its ability to simulate temporally and spatially changing conditions. Among the more important simplifications are: a variable puff generation rate, merging of closely spaced puffs, nonuniform spatial resolution of the wind field and the use of integers to represent some of the variables. A model using the simplifications was able to simulate the 24-h behavior of emissions from a power plant; concentrations were calculated at 25 points and at 43 different times. The time required on a Data General Nova 1200 minicomputer is about 6 min, but varies with different sequences of meteorological conditions. The memory required is about 24,000 words.

7404 Comparison of observed plume trajectories with those predicted by two models. Venter, G.P.N. (CSIR, Pretoria). *Atmos. Environ.;* **11**: No. 5, 421-426(1977).

Plume trajectory measurements were made at a power station on the South African Highveld under mainly near-neutral stability conditions. The maximum distance of observation ranged from 1050 to 6750 m. The fit of the models of Briggs (1969, 1970) and of Moore (1973, 1974) to the measurements was investigated. Very little difference was found between the two models. However, both models underestimated the plume rise. The scatter of observations about the predicted values is such that in almost every case the more sophisticated formulae were in practice less useful than simple approximations.

7405 Statistical oxidant air quality prediction model for land use and transportation planning. Caporaletti, J.M.; Myrabo, L.N.; Schleifer, P.; Stanonok, A.; Wilson, K.R. (Univ. of California, San Diego, La Jolla). *Atmos. Environ.;* **11**: No. 5, 449-458(1977).

A statistical model has been developed for the prediction of changes in oxidant air quality as a function of location resulting from the creation of an indirect source or the implementation of a land use or transportation plan. Los Angeles and San Diego geocoded reactive hydrocarbon emission inventories from mobile and stationary sources for 1969 and 1970 have been used with wind data and observed oxidant air quality in order to calibrate a statistical relationship between emissions and air quality. This relationship, applied to the San Diego-Tijuana region, has then been used with a 1975 base case geocoded emissions inventory to generate a base case 1975 oxidant index as a function of position. An altered 1975 geocoded emissions function incorporating the predicted emissions effects of changed land use can then be employed to generate a new 1975 oxidant function. The difference between the new and old oxidant functions represents the effect, area by area, of the change in land use on air quality. To demonstrate the possibilities of this type of model, three examples of air quality impact assessments have been carried out: first, the impact of a proposed regional shopping center, second, the effects of a proposed large scale development, third, an analysis of an "Existing Trends" 1995 alternative regional transportation and land use plan for the San Diego-Tijuana region. The resulting predicted changes in oxidant air quality, measured by the number of additional hours per year that the U.S. Federal oxidant standard is to be exceeded, are displayed as a function of position over the air basin. Given the emissions resulting from changed land use, the calculation of air quality change requires only a modest amount of computer time, and thus this type of model can inexpensively and rapidly be used to evaluate the approximate air pollution effects of planning alternatives.

7406 Catalytic reduction of nitric oxide with carbon monoxide by rare earth oxides. Peters, M.S.; Wu, J.L. (Univ. of Colorado, Boulder). *Atmos. Environ.;* **11**: No. 5, 459-463(1977).

An experimental study of the relative catalytic activities of rare earth oxides for reducing nitric oxide in the presence of carbon monoxide is reported. The tests were conducted at atmospheric pressure with nitric oxide and carbon monoxide concentrations in the range of about 0.002 to 0.04 atm at temperatures from 200 to 475°C to permit comparisons to automobile exhaust conditions. Cerium dioxide was found to be the most active catalyst among the rare earth oxides examined with activity being similar to that of platinum and palladium catalysts tested under similar conditions. The second most active of the rare earth oxides was praseodymium oxide, while the most active of the noble metal catalysts tested was ruthenium. A dual-site-model empirical equation is presented for correlation of the experimental data for the cerium oxide catalyst.

7407 Analytical model for air pollutant transport and deposition from a point source. Ermak, D.L. (Univ. of California, Livermore). *Atmos. Environ.;* **11**: 231-237(1977).

An atmospheric transport and deposition model is presented for pollutants emitted from an elevated point source over flat terrain. The model is obtained from the analytic solution of the atmospheric diffusion equation with the coefficients of eddy diffusion taken to be functions of downwind distance and the average wind velocity taken to be constant. Ground deposition of the pollutants is accounted for by (1) including a gravitational settling term in the atmospheric diffusion equation and by (2) applying an absorptive boundary condition at the ground surface. In order to facilitate application of the model, the results for the general situation that includes settling and deposition (and where the distribution is no longer Gaussian) are expressed in terms of the Gaussian plume parameters, and specifically the crosswind and vertical standard deviation functions sigma/sub y/(x) and sigma/sub z/(x). Graphs of the pollutant air concentration and ground deposition flux are presented for a number of deposition conditions.

7408 Organizing the engineering control of toxic substances in air. Coy, C.M. (Commonwealth Smelting Ltd., Bristol, Eng.). *Ann. Occup. Hyg.;* **19**: No. 3/4, 327-331(Dec 1976).

A large primary zinc lead smelter complex with its associated metallurgical and mechanical operations evolves a great deal of dust and fume at its various operating stages. Control of the environment involves a high level of effort and capital investment. There must be proper direction of both effort and investment by the management organization and engineering methods. How this is achieved and the essential concepts of control are discussed.

7409 Measurement of shift average exposures to oxides of nitrogen. Dodgson, J.; Robertson, A.; Wood, J.D. (Institute of Occupational Medicine, Edinburgh). *Ann. Occup. Hyg.;* **19**: No. 3/4, 333-344(Dec 1976).

Two sampling attachments have been designed for measuring shift average concentrations of nitrogen dioxide and nitric oxide. These can be used with dust samplers so that NO/sub x/ concentrations may be measured simultaneously with dust concentrations. The analysis procedure used is that of Levaggi et al. (1973). Laboratory and field evaluations of the sampling attachments and the analysis procedure are described. The preparation of standard mixtures of NO_2 in air is also discussed and a comparison is made between NO_2 in air mixtures produced by permeation tubes and cylinders of NO in nitrogen.

7410 Application of data analysis methods for optimization of an atmospheric pollution monitoring system. Sabaton, C. *Bull. Dir. Etud. Rech., Ser. A;* No. 4, 1-136(1976). (In French).

The aims and purposes of air pollution monitoring systems operating in French towns are discussed in this report. Can an existing operational monitoring system be replaced by one of lesser density answering the same purpose at lower cost. In an attempt to answer this question, a study has been made of the system operating in the Paris area, which comprises thirty stations run by municipal Hygiene Authorities. First, it is established how much of the total pullution recorded at a specific station originates from definite social and meteorological factors (weekday, monthly and seasonal activities, weather, wind speed and direction). Then, the available data are analyzed multi-dimensionally with a view to determining relationships between different monitoring stations. The choice of groups of stations to be maintained will depend on the results of a study of these relationships, mainly in terms of the general information pattern to be retained. Three methods based on different optimization criteria are tested with the data obtained.

7411 Experimental study of the effects of aerosols on diffuse and direct solar radiation received during the summer near Chicago. Wesely, M.L.; Lipschutz, R.C. (Argonne National Lab., IL). *Atmos. Environ.;* **10**: No. 11, 981-987(1976).

Measurements of diffuse and direct irradiance at the surface of the earth under cloudless skies have been taken during the summer at a primarily-rural location in the Midwestern U.S.A. Based on observations taken under extremely clean skies, simple empirical expressions of the direct component I and the diffuse component D, as a function of solar zenith angle 0, provide a basis for ready comparison with more-turbid conditions. A particularly sensitive indicator of turbidity is the ratio D/I, which is found to vary with wind direction at the measurement site in a manner such that considerably greater turbidity is found with southwest winds than with northwest winds. The data indicate that the gain in D associated with increased turbidity compensates for the attenuation of I by an amount that varies from 58% of the loss at 0 = 65 to 70% at 0 = 37.5°. If purely single-scattering processes and simple reflection from a surface with an albedo of 0.17 are assumed, it can be shown that the effect of adding suspended particles to the troposphere is to increase the effective albedo of the earth, with the magnitude of this increase being strongly dependent on the zenith angle.

7412 Atmospheric vanadium transport to the ocean. Duce, R.A.; Hoffman, G.L. (Univ. of Rhode Island, Kingston). *Atmos. Environ.;* **10**: No. 11, 989-996(1976).

The distribution of atmospheric vanadium in urban and remote marine areas is evaluated. It appears that most of the vanadium present in the northern hemisphere westerlies over the Atlantic and Pacific Oceans is from anthropogenic sources. Several crude models are utilized to calculate the flux of vanadium from the atmosphere to the oceans and it is concluded that approx. 10% of the anthropogenic atmospheric vanadium produced in continental areas is deposited in open ocean regions. Vanadium may serve as a valuable tracer in theoretical and experimental models designed to evaluate transport of atmospheric pollutants to the open ocean areas.

7413 Use of multivariate analysis to identify sources of selected elements in the Boston urban aerosol. Hopke, P.K. (Univ. of Illinois, Urbana); Gladney, E.S.; Gordon, G.E.; Zoller, W.H.; Jones, A.G. *Atmos. Environ.;* **10**: No. 11, 1015-1025(1976).

The concentrations of eighteen elements were determined by instrumental neutron activation analysis for samples of air particulates collected over a five month period in the Boston metropolitan area. This set of data is analyzed for underlying structure by the methods of common factor analysis and hierarchial aggregative cluster analysis. The data can be interpreted on the basis of six common factors accounting for 77.5% of the total variance in the system. These factors are attributed to various sources of particulate material by noting the dependence of the factors on the elements. The cluster analysis assists in the interpretation of the factors.

7414 Chemistry of sulfur and arsenic in airborne copper smelter particulates. Smith, T.J. (Univ. of Utah, Salt Lake City); Eatough, D.J.; Hansen, L.D.; Mangelsen, N.F. *Bull. Environ. Contam. Toxicol.;* **15**: No. 6, 651-659(1976).

Data were taken from a small series of air samples collected in a large copper smelter. Size classified particulate samples were collected on glass fiber filters. Two sulfur oxides, sulfate and sulfite, show markedly different size distributions, which suggests that they are formed by different mechanisms in the smelter environment and that sulfite is not readily converted to sulfate in the short period between generation and collection. The source of sulfate in the smelter environment is unknown; however, it is likely that the sulfate is produced as a very small aerosol by the oxidation of airborne sulfur dioxide within the reverberatory furnaces or converters, and could be catalyzed by the metals in the perticulates from the smelter. Arsenic in the HCl extracts of the samples was not present as arsenic trioxide, metal arsenites, or arsenic pentoxide. Two other forms could exist: arsenic sulfides and elemental arsenic, since both readily form colloids not removable in filtration.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 6062, 7378, 7385, 7510, 7511

7415 (BNWL—2086) **Guide to good practices at plutonium facilities.** Faust, L.G.; Brackenbush, L.W.; Carter, L.A.; Endres, G.W.R.; Glenn, R.D.; Jech, J.J.; Selby, J.M.; Smith, R.C.; Waite, D.A.; Walsh, W.P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-06-1830. 216p. Dep. NTIS, PC A10/MF A01.

This manual establishes guidelines and principles for use in setting up a sound radiation protection program for work with plutonium. The guidance presented is based on the experiences of Energy Research and Development Administration (ERDA) contractors and those portions of private industry concerned with the operation of plutonium facilities, specifically with the fabrication of mixed oxide reactor fuel. The manual is directed primarily to those facilities which have as their sole purpose the handling of large quantities of plutonium for military or industrial uses. It is not intended for use by facilities engaged in reactor or chemical separation operations nor for partial or occasional use by analytical laboratories; while these facilities would find the manual beneficial, it would be incomplete for their needs. The manual addresses good practices that should be observed by management, staff and designers, since the benefits of a good radiation protection program are the result of their joint efforts. Methods for the diagnostic evaluation of internally deposited Pu are included.

7416 (BNWL-SA—6236) **Transuranic and tracer simulant resuspension.** Sehmel, G.A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1977. Contract EY-76-C-06-1830. 84p. (CONF-770429—3). Dep. NTIS, PC A05/MF A01.

From Environmental transuranium workshop; Woods Hole, Massachusetts, United States of America (USA) (19 Apr 1977).

Plutonium resuspension results are summarized for experiments conducted at Rocky Flats, onsite on the Hanford reservation, and for winds blowing from offsite onto the Hanford reservation near the Prosser barricade boundary. In each case, plutonium resuspension was shown by increased airborne plutonium concentrations as a function of either wind speed or as compared to fallout levels. All measured airborne concentrations were below maximum permissible concentrations (MPC). Both plutonium and cesium concentrations on airborne soil were normalized by the quantity of airborne soil sampled. Airborne radionuclide concentrations in $\mu Ci/g$ were related to published values for radionuclide concentrations on surface soils. For this ratio of radionuclide concentration per gram on airborne soil divided by that for ground surface soil, there are eight orders of magnitude uncertainty from 10^{-4} to 10^{4}. Horizontal plutonium fluxes on airborne nonrespirable soils at all three sites were bracketed within the same three to four orders of magnitude from 10^{-7} to 10^{-3} $\mu Ci/(m^2\ day)$ for plutonium-239 and 10^{-8} to 10^{-5} $\mu Ci/(m^2\ day)$ for plutonium-238. These are the entire experimental base for nonrespirable airborne plutonium transport. Airborne respirable plutonium-239 concentrations increased with wind speed for a southeast wind direction coming from offsite near the Hanford reservation Prosser barricade. Airborne plutonium fluxes on nonrespirable particles had isotopic ratios, $^{240}Pu/^{239+240}Pu$, similar to weapons grade plutonium rather than fallout plutonium. Resuspension rates were summarized for controlled inert particle tracer simulant experiments. Wind resuspension rates for tracers increased with wind speed to about the fifth power.

7417 (COO—1199-7) **1964 Project Springfield studies. Research Report 2.** Feteris, P.J. (Illinois State Water Survey, Urbana (USA)). Oct 1975. Contract EY-76-S-002-1199. 37p. Dep. NTIS, PC A03/MF A01.

The analysis of the data for a storm on April 4, 1964, showed that in spite of all efforts to obtain a dynamically and internally consistent three-dimensional analysis of conventional wind, pressure, and temperature data, there remain ambiguities of 50 to 100 miles in the horizontal location of the boundaries of the stratospheric air. Missing wind data and temperature errors, though not disastrous in routine meteorological analysis, can seriously affect the potential vorticity computations for several isentropic surfaces. Trajectory analyses introduce additional errors. Aircraft measurements of fallout beta activity, when carefully planned and made at map time, can improve the precision to 1000 feet in the vertical, and to a few miles in the horizontal. This precision is necessary for conclusive proof of the capture of radioactive particles from the stratosphere by precipitating clouds. However, for large-scale global studies of fallout transport, errors of 50 to 100 miles in the location of air parcels with certain potential. During the 1963 study, it was found that the flow patterns at different levels were seriously affected by coding and plotting errors in the radiosonde data which often escape attention in conventional upper air analyses.

7418 (LF—56, pp 7-10) **Sampling equipment and procedures used in field characterization of industrial plutonium aerosols.** Teague, S.V.; Newton, G.J. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Equipment and procedures used to collect samples of plutonium aerosols produced in industrial operations are described. Aerodynamic size, density, isotopic composition, in vitro solubility, specific activity and electrostatic charge properties of aerosol particles collected during normal working conditions provide information for the evaluation of potential health hazards and also serve as a comparison to well-characterized, laboratory-produced aerosols. The sampling of plutonium aerosols in an industrial environment presents special problems that require easily moved, reliable sampling equipment. Accurate measurements of activity levels and aerosol size distribu-

tions from inside safety enclosures during normal working conditions require calibrated flow instruments and accurate time measurements. The potential for encountering very high aerosol concentrations requires adequate radiological control to prevent any release. The sampling system described herein encompasses calibration, hook up, sampling proper, and sample storage.

7419 (LF—56, pp 25-27) **Solubility characteristics of some laboratory-produced mixed oxide aerosols.** Miglio, J.J.; Pritt, J.W. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Solubility rate characteristics of aerosols of mixed actinide oxides were compared. In addition, X-ray diffraction studies were conducted on UO/sub x/ aerosols to determine the oxidation states of the oxides present. The results indicate that for aerosols that contain greater than 99 percent PuO_2, specific activity of the aerosol is an important factor controlling the solubility rate. For other aerosols, the presence of the uranium is the dominant factor in determining the solubility rate characteristics.

7420 (LF—56, pp 33-36) **Generation of uniform density transuranium oxide aerosols by gas phase neutralization of acidic droplets.** LaBauve, R.J.; Kanapilly, G.M.; Mewhinney, J.A.; Stalnaker, N.D. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A method is described for the production of uniform density aerosols of transuranic metal oxides from a solution rather than a colloidal hydroxide suspension as is presently done. The use of colloidal hydroxide suspension has the disadvantage that the suspensions are unstable under conditions of high specific activity of solutions of alpha-emitting radionuclides. The pure solution does not suffer from this drawback and therefore this method is applicable to production of smooth spherical aerosols of uniform density from high specific activity transuranic elements.

7421 (LF—56, pp 41-43) **Fabrication and use of krypton-85 aerosol discharge devices.** Teague, S.V.; Yeh, H.C.; Newton, G.J. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Highly charged aerosols can be discharged by a bipolar ion field to bring them down to near Boltzmann equilibrium. Beta radioactive sources have been used successfully in the past for this purpose. Calculations of the bipolar ion concentration, design criteria, a method for making ^{85}Kr tube sources and a simple method for estimating source activity are presented. Using a 10 mCi ^{85}Kr beta source in a thin-wall stainless steel tube placed in an aluminum cylinder 10.2 cm in diameter and 30.5 cm long (net volume of approximately equal to 1.8 l), charge reduction can be achieved for flow rates up to 120 l/min.

THERMAL EFFLUENTS MONITORING AND TRANSPORT

7422 **Airborne electrical and microphysical observations in the environment of a thermal power station.** Selvam, A.M.; Ramachandra Murty, A.S.; Vijayakumar, R.; Ramana Murty, B.V. (Indian Inst. of Tropical Meteorology, Poona). *Atmos. Environ.;* **10**: No. 11, 957-961(1976).

Using aircraft, electrical and microphysical observations were made, on a few occasions within 15 km upwind and downwind of a thermal power station under cloud-free and in-cloud conditions. The values of the parameters measured were found to be systematically higher in the downwind region than in the upwind. Under cloud-free conditions, the concentrations of the cloud condensation nuclei and the computed cloud droplets were higher up to two times, the atmospheric electric field was higher up to seven times and the air temperature up to 2.3°C. Under in-cloud conditions, the values of the electric field and droplet charge were higher up to two times, the measured droplet concentration was higher by one and a half times, the cloud air temperature up to 1.5°C and the liquid water content up to four times. However, these differences were in general within the spatial variability found outside the plume affected area.

7423 **Rainfall variations around a thermal power station.** Selvam, A.M.; Manohar, G.K.; Ramana Murty, B.V. (Indian Inst. of Tropical Meteorology, Poona). *Atmos. Environ.;* **10**: No. 11, 963-968(1976).

Rainfall data of Neyveli thermal power station and of stations within 100 km around were examined, after eliminating the secular trends for the period 1958 to 1974. The analysis suggested that, with respect to nearby stations in the distance range 12 to 25 km, rainfall at a gauge 1 km from the power station increased in the last 6 y of the period by over 25%.

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 7337

REGULATIONS

REFER ALSO TO CITATION(S) 6425, 6870, 6872, 6944

7424 **Short-term exposure limits.** Ferguson, D.M. (ICI Ltd., Central Medical Group, Wilmslow, Eng.). *Ann. Occup. Hyg.;* **19**: No. 3/4, 275-282(Dec 1976).

There is a growth of interest in exposure limits to environmental contaminants that apply not to a full work day, but to periods of much shorter duration. The paper outlines the general methods used to derive such limits and reviews activities in this field over the past 10 yr. Short-term exposure limits are available that apply to normal industrial operations and to emergency situations. In the latter instance, they have been developed both for "selected" populations, such as industrial or military personnel, and for the general public. Their major purpose is for advance planning for the management of emergencies. The Toxicology Committee of the American Industrial Hygiene Association has proposed Emergency Exposure Limits (EELs) for nitrogen dioxide, 1,1-dimethyl hydrazine, 1,1,1-trichloroethane, pentaborane-9. The National Research Council Committee on Toxicology has published EELs for oxygen difluoride, fluorine, monomethyl hydrazine, hydrogen fluoride, hydrogen chloride, nitrogen dioxide, sulfur dioxide, carbon monoxide, carbon disulfide and hydrogen disulfide. Details of available sources of information are given.

ENVIRONMENTAL SCIENCES, TERRESTRIAL

REFER ALSO TO CITATION(S) 7180

BASIC STUDIES

REFER ALSO TO CITATION(S) 7440, 7494

7425 (ANL/ES—40(Vol.14)) **Environmental status of the Lake Michigan region. Volume 14. Birds of the Lake Michigan drainage basin.** Wallace, G.J. (Argonne National Lab., Ill. (USA)). Jul 1977. Contract W-31-109-ENG-38. 114p. Dep. NTIS, PC A06/MF A01.

This report characterizes the bird life found in 100 counties of the four states peripheral to Lake Michigan. It discusses major habitats (the Lake Michigan shoreline, inland lakes, rivers and streams, marshes, fields and open spaces, and woodlots) and associates specific birds with habitats according to preferences for space and food. It also discusses the special attributes of state parks and lakeshores, refuges and sanctuaries, and other special areas which are attractive to avifauna. Patterns of historical occurrence and abundance, and the influence of pesticides and pollution, disease, and hunting pressure are explored to place present occurrence in a modern perspective. Migration patterns are discussed to explain increases and decreases which occur in nonresident avifauna of the Basin. The distribution and habits of birds that occur regularly in the Basin are described in an annotated list; a more complete list is presented in a table which encapsulates data for rapid and convenient reference. Separate sections deal with extinct, extirpated, and introduced species, and with endangered, threatened, and declining species.

7426 (CONF-7609160—) **Workshop on research needs for atmospheric transport and diffusion in complex terrain.** Barr, S.; Luna, R.E.; Clements, W.E.; Church, H.W. (eds.). (Los Alamos Scientific Lab., N.Mex. (USA); Sandia Labs., Albuquerque, N.Mex. (USA)). Sep 1977. 24p. Dep. NTIS, PC A02/MF A01.

From Workshop on research needs for atmospheric transport and diffusion in complex terrain; Albuquerque, New Mexico, USA (28 Sep 1976).

The energy conversion activities in the western United States involve substantial environmental impacts. Air quality impact of oil shale production facilities is of particular interest because of federal regulations for the prevention of significant deterioration of air quality. In addition, knowledge must be available to prepare for possibly more stringent requirements in the future as increasing demands for energy conflict with the continuing identification of subtle environmental effects. Terrain-dominated flows, which are exceptions from the point of view of modeling technology are, in the real world, not exceptional at all but represent a majority of practical

cases. Fundamental knowledge about governing phenomena is sketchy and inadequate. Until a quantitative understanding of complex terrain transport and diffusion is accomplished, the assessment techniques must, of necessity, rely on oversimplifed concepts and have minimal credibility. The workshop proposed an integrated program of mathematical model development, field experiments, physical model experiments, and theoretical research involving air pollution meteorology in complex terrain should be supported at a level of 5 to 6 million dollars per year for a period of 3 to 5 years.

7427 Sources and sinks of atmospheric N_2O and the possible ozone reduction due to industrial fixed nitrogen fertilizers. Liu, S.C. (Univ. of Michigan, Ann Arbor); Cicerone, R.J.; Donahue, T.M.; Chameides, W.L. *Tellus;* **29**: No. 3, 251-263(Jun 1977).

The terrestrial and marine nitrogen cycles are examined in an attempt to clarify how the atmospheric content of N_2O is controlled. We review available data on the various reservoirs of fixed nitrogen, the transfer rates between the reservoirs, and estimate how the reservoir contents and transfer rates can change under man's influence. It is seen that the sources, sinks and lifetime of atmospheric N_2O are not understood well. Based on our limited knowledge of the stability of atmospheric N_2O we conclude that future growth in the usage of industrial fixed nitrogen fertilizers could cause a 1 percent to 2 percent global ozone reduction in the next 50 years. However, centuries from now the ozone layer could be reduced by as much as 10 percent if soils are the major source of atmospheric N_2O.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 5794, 5842, 5843, 5877, 6432, 6435, 6447, 7380, 7385, 7565

7428 (ORO/4940—1) Oil persistence in tundra and its impact on the belowground ecosystem. Progress report, June 1, 1975—March 1, 1976. Miller, O.K. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 1976. Contract EY-76-S-05-4940. 146p. Dep. NTIS, PC A07/MF A01.

Progress is reported on an investigation into the effect on the belowground ecosystem by oil spilled directly onto the tundra. The rate of oil penetration into tundra soil and the subsequent changes in soil morphology, soil constituents, higher plant root physiology, total soil respiration, and the shifts in bacterial and fungal populations were measured in 6 to 14 square meter plots treated with Prudhoe crude oil at the rate of 5 and 12 liters per square meter. Sampling commenced 48 hours after the initial spill on July 2, 1975 and was repeated every 15 days through the 27th of August. In order to obtain information of the long term effect of oil, a 5 year old CRREL study was resampled along with a 29 year old diesel fuel oil spill at Umiat. The impact of a natural oil seep at Cape Simpson on the belowground ecosystem was studied to provide data on the long-term effect of oil.

7429 (ORO/4940—2) Oil persistence in tundra and its impact on the belowground ecosystem. Progress report, June 1, 1976—March 1, 1977. Miller, O.K. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 1977. Contract EY-76-S-05-4940. 153p. Dep. NTIS, PC A08/MF A01.

Field work was initiated on June 26, 1975 at Barrow, Alaska to explore the effects of Prudhoe crude oil on the belowground ecosystem. A polygon system on IBP Site 4 was selected along with a series of high center polygon plots on IBP Site 1. Both of these sites are near the Naval Arctic Research Laboratory. The plots formed the framework for the careful monitoring of oil spilled at 5 liters and 12 liters per square meter. To gain some historical insight into the long term effect of oil in tundra nine plots were also sampled along with a 30 year old diesel oil spill at Umiat. In an effort to explore the long term effect of crude oil on the belowground ecosystem a natural oil seep at Cape Simpson was included in the study. The plants growing in this oil and the belowground ecosystem were studied. Results are reported on chemical and physical changes at various depths produced by oil spills on soils, effects on growth of bacteria and fungi, root respiration of higher plants, effects on nitrogen cycling populations, and effects on the content of soluble cellulose in arctic tundra soils.

7430 Relative decomposition potential of habitats variously affected by surface coal mining. Lawrey, J.D. (Ohio State Univ., Columbus). *Can. J. Bot.;* **55**: No. 11, 1544-1552(1 Jun 1977).

In a 20-year-old abandoned surface coal mine area in eastern Ohio, fiber glass litter bags containing leaves of Robinia pseudoacacia, Pinus resinosa, and Acer rubrum were set out in three habitats: a non-vegetated strip-mined area, a strip-mined area dominated by Robinia pseudoacacia, and an adjacent unstripped area dominated by Fagus grandifolia and Acer saccharum. From 1 to 6 months after litter fall, there were statistically significant differences in Robinia and Acer leaf litter dry weight between the bare strip-mined habitat and either of the vegetated habitats, both strip-mined and unstripped. After 6 months of decomposition time, rates of decomposition based on dry weight loss became equalized for all litter types in all habitats except for Robinia leaves between the non-vegetated and the vegetated strip-mined habitats. This indicates that changes in decomposition potential because of strip-mining influence the early stages of litter decay. Calculated values for soil pH, texture, organic carbon content, and trace element content indicated that soils from strip-mined habitats contained greater levels of heavy metal cations and were more acidic. Soils from the control area unaffected by mining contained high percentages of sand-sized particles and low concentrations of trace elements, including metals. Soil respiration data measured by manometric techniques in January and April showed significant differences between the strip-mined habitats and the unaffected habitat. In addition, numbers of soil fungi isolated from soil samples of each habitat were higher in the unstripped control area than in either of the strip-mined areas. Leaf litter decomposition processes appear to be functionally more resistant to environmental impact than is apparent when structural diversity and complexity of soil populations are considered.

7431 Nitrification in three soils amended with zinc sulfate. Wilson, D.O. (Univ. of Georgia, Georgia Station). *Soil Biol. Biochem.;* **9**: No. 4, 277-280(1977).

Zinc as $ZnSO_4$ was added to three soils at rates of 0, 10, 100 and 1000 μg Zn g^{-1} soil. The soils were uniformly treated with 100 μg N g^{-1} as NH_4Cl, incubated at 30°C and NH_4^+-N and (NO_3^- + NO_2^-)-N determined weekly for 7 weeks. Nitrification in all three soils was totally inhibited by 1000 μg Zn g^{-1}. At the 100 μg Zn g^{-1} rate, nitrification was significantly reduced in two of the three soils during some part of the incubation. This differential effect on nitrification at the 100 μg Zn g^{-1} rate was related to differences in soil properties. These results imply that, with respect to nitrification, care should be taken not to apply Zn-containing materials indiscriminately to soils.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 6074, 6075, 6076, 6077, 7378, 7385

7432 (LF—56, pp 21-24) Rapid method for determining the relative solubility of plutonium aerosols. Miglio, J.J.; Muggenburg, B.A.; Brooks, A.L. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

An in vitro system for rapidly determining the relative solubilities of plutonium-containing aerosols has been developed. Aerosols prepared by nebulizing a solution of $PuCl_4$, subsequently heated at 50, 325, 600, 900, 1150 or 1300°C, were evaluated as to relative solubility. These results were compared with in vivo data from Chinese hamsters. Aerosol samples collected on filters during animal inhalation exposures were sandwiched between 100 nanometer pore size filters held in a two-piece, cylindrical, polyethylene holder. The holder and filter were placed in a container of solvent and stirred gently, after which the filter and solvent were separately analyzed for plutonium. Effects of solvent composition, volume, temperature and immersion time were investigated. Using 0.1N HCl at 23°C as a solvent and an immersion time of 2 hr, sufficient plutonium dissolved to be easily counted with a liquid scintillation counter. The in vivo and in vitro results were in relative agreement; as the production temperature of the aerosol increased the solubility decreased.

SOIL

REFER ALSO TO CITATION(S) 6073

7433 Plutonium activities in soil solutions and the stability and formation of selected plutonium minerals. Rai, D.; Serne, R.J. (Battelle Pacific Northwest Labs., Richland, WA). *J. Environ. Qual.;* **6**: No. 1, 89-95(1977).

Selected thermodynamic data are used to develop solid phase-soil solution equilibria diagrams which are used to predict and understand plutonium behavior in terrestrial environments. The plutonium mineral transformations in soils are highly dependent upon the pH, Eh, and the soil solution composition. The predictions of weathering and formation sequences of $Pu(OH)_3$, $Pu(OH)_4$, $PuO_2(OH)$, $PuO_2(OH)_2$, PuO_2, βPu_2O_3, PuF_3, PuF_4, PuO_2CO_3, and $Pu(HPO_4)_2$ at pH values from 3 to 11 at pO_2 from 0.68 to 80, in an assumed weathering environment, are given. The study shows that the PuO_2 is the most stable mineral in the pH and pO_2 ranges found in the terrestrial environments. The nature and activity of ions and ion-complexes and, hence, the total plutonium in solution is a function of the stable phase, pH, Eh, and complexing anions. Empirical predictions regarding the plutonium sorption by soils are outlined and verified by experimental results reported in the literature. The

deficiencies in the present thermodynamic data and future research needs are outlined.

TERRESTRIAL ECOSYSTEMS AND FOOD CHAINS

REFER ALSO TO CITATION(S) 7542

7434 (CONF-770409—11) **Plutonium and americium in the foodchain lichen-reindeer-man.** Jaakkola, T.; Hakanen, M.; Keinonen, M.; Mussalo, H.; Miettinen, J.K. (Helsinki Univ. (Finland). Dept. of Radiochemistry). 1977. Contract EY-76-C-02-3011. 4p. Dep. NTIS, PC A02/MF A01.

From 4. congress of the International Radiation Protection Agency; Paris, France (24 Apr 1977).

The atmospheric nuclear tests have produced a worldwide fallout of transuranium elements. In addition to plutonium measurable concentrations of americium are to be found in terrestrial and aquatic environments. The metabolism of plutonium in reindeer was investigated by analyzing plutonium in liver, bone, and lung collected during 1963-1976. To determine the distribution of plutonium in reindeer all tissues of four animals of different ages were analyzed. To estimate the uptake of plutonium from the gastrointestinal tract in reindeer, the tissue samples of elk were also analyzed. Elk which is of the same genus as reindeer does not feed on lichen but mainly on deciduous plants, buds, young twigs, and leaves of trees and bushes. The composition of its feed corresponds fairly well to that of reindeer during the summer. Studies on behaviour of americium along the foodchain lichen-reindeer-man were started by determining the Am-241 concentrations in lichen and reindeer liver. The Am-241 results were compared with those of Pu-239,240. The plutonium contents of the southern Finns, whose diet does not contain reindeer tissues, were determined by analyzing autopsy tissue samples (liver, lung, and bone). The southern Finns form a control group to the Lapps consuming reindeer tissues. Plutonium analyses of the placenta, blood, and tooth samples of the Lapps were performed.

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 5829, 5834, 5839, 5846, 6878, 6963, 6973

7435 (ANL-LRP—77-1) **Breeding and selection of plant materials for rehabilitation of mine spoils. Progress report.** Stutz, H.C. (Brigham Young Univ., Provo, Utah (USA)). Apr 1977. Contract W-31-109-ENG-38. 15p. Dep. NTIS, PC A02/MF A01.

Because strip mine spoils are significantly different from native communities, the plants which will ultimately occupy them will necessarily also be different. A number of species already grow elsewhere in the world in somewhat similar harsh environments, and these may be immediately successful when introduced to mine spoils. There are also a number of hybrids and hybrid products from contrasting adaptive parents which may be immediately successful. These, together with derivatives from controlled breeding and selection programs, can be expected to provide the permutations of germ plasm which will include types specifically adapted to growth on strip mine spoils. Utah International's Navajo Mine was selected as a research site for the development of plants suitable for rehabilitating mined land. Because the disturbed areas at the Navajo Mine are mostly heavy saline clays, the plants most likely to be immediately successful under the regime of hot summers, cold winters, and sporadic, low precipitation are members of the family Chenopodiaceae and particular species of grasses. The plants which are being used in this research are Atriplex and grasses from the tribe Hordeae. The growth of containerized and seed-sown plants following irrigation only, irrigation plus fertilizer, fertilizer only, or unamended were studied. Preliminary data on population dynamics and hybridization are reported.

7436 (BNWL—2296) **Hanford wells.** McGhan, V.L.; Damschen, D.W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1977. Contract EY-76-C-06-1830. 198p. Dep. NTIS, PC A09/MF A01.

The Hanford Site contains about 2200 wells constructed from pre-Hanford Works days to the present. As of June 1977, about 1900 wells still exist, and about 850 of these existing wells were drilled to the ground-water table. About 700 of these wells (including about 24 farm wells) still contain water. The others have become dry through infiltration of sediments or a general lowering of the water table in their vicinity. This report, providing the most complete documentation of wells in and adjacent to the Hanford Site, supersedes all previous compilations of Hanford wells.

7437 (DP—1477) **Ash basin reclamation with forest trees.** Horton, J.H.; McMinn, J.W. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Sep 1977. Contract EY-76-C-09-0001. 36p. Dep. NTIS, PC A03/MF A01.

An ash basin at the Savannah River Plant, Aiken, South Carolina is growing trees as well as, and with some species better than, a local soil. The basin contains ashes from a stoker-fed boiler and was last used about 12 years before the trees were planted. The concentrations of 24 chemical elements were measured in ashes, soil and trees. The concentrations of most of the chemical elements were higher in ashes than in soil; however, with a few exceptions, these elements were less available to the trees on ashes than to the trees on soil. The trees do not show any toxicity or deficiency symptoms, but the concentration of manganese in sycamore growing on ashes indicates a possible deficiency. No concentration of an element in trees appears to be high enough to be toxic to the trees. A longer period of study will be required to determine whether the ashes can produce commercial timber, but trees can be used to stabilize ash basins and improve their appearance.

7438 (ERDA—1556-D) **High Flux Neutron Source Facility, Hanford Reservation, Richland, Washington. Draft environmental impact statement.** (Energy Research and Development Administration, Washington, D.C. (USA)). Jul 1977. 200p. Pennington, Office of NEPA Coordination, Hqs.

The proposed site for the Deuterium-Lithium High Flux Neutron Source (HFNS) Facility is in the 300 Area of the Hanford Reservation. The 559-square mile, federally-owned Hanford Reservation is located in parts of Benton, Grant, Adams, and Franklin Counties in south-central Washington State. The 300 Area is in the southeast corner of the Reservation. The Deuterium-Lithium High Flux Neutron Source (HFNS) Facility is in a preliminary design stage. Thus, very conservative estimates were used in evaluating the environmental effects of the HFNS during construction and normal operations. The proposed HFNS will utilize a linear accelerator to provide a high energy beam of deuterons which produce neutrons by a stripping reaction with flowing liquid lithium metal. The neutrons subsequently strike material test specimens. This system will provide a peak neutron flux of approximately 10^{15} n/cm^2-s, in a one-liter test volume, with a neutron spectrum representative of fusion reactor conditions.

7439 (ORNL/TM—6009) **Developments in ecology in systems analysis and land-use planning. Environmental Sciences Division Publication No. 1074.** Shugart, H.H.; Klopatek, J.M.; Emanuel, W.R. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 52p. Dep. NTIS, PC A04/MF A01.

The need for ecological analysis in land-use planning has become increasingly evident as mans' land-intensive activities continually lead to conflict or to difficult decisions. Systems-analysis techniques useful in land-use planning are discussed. Particular emphasis is placed on ecological and environmental aspects of the problem. Three particular approaches to different parts of the overall land-use problem are given as examples of the application of systems analysis in this area. Simulation models for forest succession at the stand and landscape level provide a tool for studying natural land-use transition. Energy-based models are used to analyze the land-use plan for an area where mans' activities dominate. Finally, multiple objective optimization is discussed as a framework for planning, which allows the consideration of trade-offs between conflicting planning criteria and integrates decision makers in the analysis. 80 references.

REGULATIONS

REFER ALSO TO CITATION(S) 6944

ENVIRONMENTAL SCIENCES, AQUATIC

REFER ALSO TO CITATION(S) 6440

BASIC STUDIES

REFER ALSO TO CITATION(S) 7427, 7615

7440 (BNL—50675) **Data report: Meadow/Marsh/Pond System.** Small, M.; Wurm, C. (Brookhaven National Lab., Upton, N.Y. (USA)). Apr 1977. Contract EY-76-C-02-0016. 33p. Dep. NTIS, PC A03/MF A01.

The Meadow/Marsh/pond is one of two natural sewage-treatment systems constructed at Brookhaven National Laboratory. This and a Marsh/Pond system have been in various modes of continuous operation since 1973 and will continue in the future. Both systems are unique in removing nutrients and contaminants from

sewage without the use of conventional hardware or the generation of sludge for separate disposal. They are economical to build and operate. They are attractive systems, free of disease vectors, aerosols and objectional odors. When sufficient land is available, the Meadow/Marsh/Pond appears superior for renovating blends of septage and weak sewage to groundwater recharge quality.

7441 Phosphorus status of eutrophic lake sediments as related to changes in limnological conditions-phosphorus mineral components. Wildung, R.E.; Schmidt, R.L.; Routson, R.C. (Battelle Pacific Northwest Labs., Richland, WA). *J. Environ. Qual.;* **6**: No. 1, 100-104(1977).

Studies of the relationship between limnological factors and changes in the P status of noncalcareous sediments of a eutrophic lake previously indicated that changes in sediment inorganic P were directly related to the biological productivity of the surface waters. The inorganic P components responsible for these changes were identified using chemical techniques for characterization of P in sediments where changes occurred. Release of P from sediments during periods of maximal biological productivity in the shallow bay waters was due primarily to reductions in inorganic P mineral components soluble in NaOH (0.1M) and citrate-dithionite, suggesting that P associated with hydrated Fe oxides was the principal source of P to the overlying waters and to the biota. Increases in sediment inorganic P, which occurred when phytoplankton growth diminished, were due principally to increases in P mineral components soluble in NH_4F, indicating that resorbed P was F-exchangeable and/or associated with crystalline and amorphous AI-P components. Changes in the form of sediment P which occurred in the lake and in laboratory equilibrium studies, indicated that conversion of resorbed NH_4F soluble-P to NaOH (0.1M) and citrate-dithionite soluble-P, must be a relatively long term (>2 years) process. Taken together, the NH_4F, NaOH (0.1M), and citrate-dithionite fractions accounted for approximately 85% of the seasonal variance in total inorganic P which occurred at all sampling locations in the lake system.

7442 Interference competition as a mechanism of coexistence between two sympatric species of the grass shrimp Palaemonetes (Decapoda: Palaemonidae). Thorp, J.H. (North Carolina State Univ., Raleigh). *J. Exp. Mar. Biol. Ecol.;* **25**: 19-35(1976).

Various theories have been developed to explain the puzzling coexistence of species which have broad niche overlap in critical resource utilization. The coexistence of two sympatric species of grass shrimp, Palaemonetes pugio Holthuis and p. vulgaris (Say), whose niches overlap with respect to space, food, and time, was examined in an experimental field and laboratory study. A seasonal fluctuation between sympatric and contiguous allopatric distribution of the two species of grass shrimp on natural shell, mud, and eelgrass substrata suggests that competition may be an important factor determining distribution of Palaemonetes. Field and laboratory experiments confirm that P. vulgaris can competitively displace P. pugio from the preferred shell substratum by interference competition but the tendency of grass shrimp to separate spatially in winter by bottom-depths (as in field enclosure cages) could have allowed both species to coexist on shell. Spatial separation by bottom-depth was not so evident in spring, since P. vulgaris apparently displaced P. pugio from shell to mud substratum. Occupancy of shell substratum is shown to be adaptive in that shell provides greater protection from predators than does mud. It is suggested that the spatial partitioning resulting from this interference competition promotes coexistence by reducing agonism while permitting efficient utilization of other common resources.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 5794, 5828, 5842, 5843, 5877, 5972, 5975, 5985, 6703, 7378, 7379, 7380, 7384, 7385, 7388, 7412, 7570, 7575, 7578

7443 (CONF-770830—3) **Dissolution of diatom frustules and silicon cycling in Lake Michigan, U.S.A.** Parker, J.I.; Conway, H.L.; Yaguchi, E.M.; Edgington, D.N. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 15p. Dep. NTIS, PC A02/MF A01.

From 20. congress of the International Society of Limnology; Copenhagen, Denmark (7 Aug 1977).

Diatoms require dissolved silicon for the formation of the silicate frustule that surrounds the cell. Potential sources of this silicon include dissolution of frustules produced by previous diatom communities, inputs of dissolved silicon from land drainage, and dissolution of silicate minerals. Results are reported from investigations on the relationship between diatom-frustule production, sedimentation, and dissolution to determine the importance and the mechanisms of silicon recycling in a large temperate lake, Lake Michigan.

7444 Regional geochemical data in relation to seasonal variations in water quality. Aston, S.R.; Thornton, I. (Imperial College of Science and Technology, London). *Sci. Total Environ.;* **7**: No. 3, 247-260(May 1977).

Over the period of twelve months the concentrations of iron, manganese, copper, lead, zinc and cadmium were determined in the waters and sediments from selected sites on tributaries of the Carnon, Red, Gannel, and Fowey catchments. Comparisons of contaminated and background drainage suggest that the average composition of sediment is useful for the prediction of areas where concentrations of potentially toxic elements in waters may exceed recommended limits. Tentative threshold values for regional geochemical data based on stream sediment surveys have been suggested for application in water quality evaluation.

7445 Hydrocarbon status in Florida real estate canals. Hansen, W.G.; Bitton, G.; Fox, J.L.; Brezonik, P.L. (Univ. of Florida, Gainesville). *Mar. Pollut. Bull.;* **8**: No. 3, 57-62(Mar 1977).

The level of hydrocarbons present in the sediments of real estate canals on the east and west coast of Florida was determined using gas chromatography. Although the amount of alkanes present was found to be comparatively low, the ratio of the amount of odd carbon-numbered alkanes to even carbon-numbered alkanes suggested that canals on the Gulf of Mexico are receiving an influx of petroleum products. In addition, the most probable number technique was used to enumerate total aerobic heterotrophic bacteria, aerobic hydrocarbon-degrading bacteria, sulfate reducing bacteria, and sulfate-reducing hydrocarbon-degrading bacteria present in the canal sediments. Results showed significantly higher numbers of hydrocarbon degrading bacteria in the sediments of the west coast canals.

7446 Oil spill in Hong Kong. Spooner, M.F. (Marine Biological Association, Plymouth, Eng.). *Mar. Pollut. Bull.;* **8**: No. 3, 62-65(Mar 1977).

Fish farming was seriously but only temporarily affected by a large spill of a very toxic product oil at Hong Kong. Field experiments were set up to follow tainting and depuration. Studies were made of hydrography, water quality, oil in sands, macro- and meiofauna of shores, and some observations made of possible effects on plankton and open-water fisheries.

7447 Dissolved and particulate trace metals in the Rhine estuary and the Southern Bight. Duinker, J.C.; Nolting, R.F. (Netherlands Inst. for Sea Research, Texel). *Mar. Pollut. Bull.;* **8**: No. 3, 65-71(Mar 1977).

Dissolved and particulate trace metals have been measured in the Southern Bight and the Rhine estuary in order to study the relative importance of precipitation and sedimentation processes as compared to mobilization processes in the estuary, and their impact on trace metal levels in the Southern Bight.

7448 Heavy metal concentrations in Ontario fish. Brown, J.R.; Chow, L.Y. (Univ. of Toronto). *Bull. Environ. Contam. Toxicol.;* **17**: No. 2, 190-195(Feb 1977).

The concentration of cadmium, copper, lead, zinc and mercury in muscle taken from fish caught in Lake Huron at Toronto Harbor is higher than those found in Baie du Dore. This reflects the concentration of these elements in the sediment. Metal concentrations in the sediment of the Don River (draining a concentrated industrial area) are high in comparison with Baie du Dore, which has minimal industrial effluent drainage.

7449 Removal of soluble mercury from water by rubber. Wheeler, S.R.; Hamdy, M.K. (Univ. of Georgia, Athens). *Bull. Environ. Contam. Toxicol.;* **17**: No. 2, 150-158(Feb 1977).

The most practical approach to the control of mercury pollution would seem to be one of prevention; purifying the effluent waste prior to its discharge. The results of a study using columns of ground rubber or active carbon for removal of inorganic mercury from water is described. Radioactive mercury nitrate $^{203}Hg(NO_3)_2$ was used for ease and accuracy of detecting small amounts of mercury. Small columns containing measured quantities of either ground rubber (GR) or active carbon (AC) were constructed. Ten milliliters of $^{203}Hg^{2+}$ solution was recirculated through the column for 10 cycles with aliquots removed after each cycle to ascertain decrease in activity. The decrease in $^{203}Hg^{2+}$ activity from solutions, cycled through the control column is due to chemisorption by walls of the column and vial, as well as by the fiberglass plug. More efficient removal might be realized if effluent containing Hg^{2+} was concentrated prior to cycling it through GR columns.

7450 Correlation coefficients and concentration factors of copper and lead in seawater and benthic algae. Seeliger, U.; Edwards, P. (Rutgers-The State Univ., New Brunswick, NJ). *Mar. Pollut. Bull.;* **8**: No. 1, 16-19(Jan 1977).

Raritan Bay, which is adjacent to the New York metropolitan area, served as a study site to investigate the relationship between copper and lead concentrations in water and in seaweeds. Correla-

tion coefficients of 0.98 for copper and 0.97 for lead indicate a high degree of correspondence between levels of these metals in water and in algal tissue. Concentration factors of 18.4×10^4 for copper and 8.2×10^4 for lead are among the highest reported to date.

7451 Chemical quality of effluents and their influence on water quality in a shallow aquifer. Purtymun, W.D. (Los Alamos Scientific Lab., NM); Buchholz, J.R.; Hakonson, T.E. *J. Environ. Qual.;* 6: No. 1, 29-32(1977).

The chemical quality of liquid effluent released from an industrial waste treatment plant at the Los Alamos Scientific Laboratory controls the quality of water in a shallow aquifer in the alluvium of Mortandad Canyon. The dilution of the effluent with surface flow in the canyon reduces the concentrations of the chemicals as they move down gradient into the aquifer. Mass estimates of residual chemicals in solution in the aquifer average 1 to 6% of the total chemicals released to the canyon from 1963 to 1974. The average annual concentration of sodium, nitrate, chloride, and total dissolved solids in the aquifer through a 12-year period was directly correlated with annual average concentrations in the effluent. A model was developed for predicting the impact of chemical effluents on the quality of water in the aquifer.

7452 Forms of sulfur in sewage sludge. Sommers, L.E.; Tabatabai, M.A.; Nelson, D.W. (Purdue Univ., W. Lafayette, IN). *J. Environ. Qual.;* 6: No. 1, 42-46(1977).

Most studies concerning the composition of sewage sludge have placed emphasis on total elemental analysis, including sulfur. This study was conducted to determine the forms of S and their relationships to other components in sludge. Analyses of the forms and amounts of S in sewage sludge produced by 11 Indiana cities showed that total S concentrations ranged from 0.7 to 2.1% and that from 1 to 27% of the total sludge S was inorganic S extractable with 0.1M LiCl. Expressed as a percentage of total S, the sludge samples contained from <1 to 35% sulfide S, from 18 to 53% inorganic nonsulfate S, from 18 to 56% carbon-bonded S, from 0 to 35% ester sulfate S and inorganic sulfate S, and from 0 to 42% unidentified organic S. Analyses of seven sludge samples obtained over a 2-year period from the same treatment plant indicated that the forms of S in sludge vary with time. No consistent relationships were found between the amounts of organic C, N, S, and P in sludges. Statistical analyses of the sludge components indicated that Pb and Zn were significantly correlated with sulfide S and that Cd was significantly correlated with organic S, ester sulfate S, and with 0.1M LiCl extractable S. No significant relationships were found for other metals and the various S fractions.

7453 Effect of some pollutants on the filtration rate of Mytilus. Abel, P.D. (Univ. of Newcastle upon Tyne, Eng.). *Mar. Pollut. Bull.;* 7: No. 12, 228-231(Dec 1976).

The feeding and respiratory mechanism of the mussel is impaired by the presence of pollutants in low concentrations. The effect can be measured by a simple technique which is of potential value as a rapid, sensible and economical toxicity test based on a sublethal response of ecological significance.

7454 Baseline levels of benzo(a)pyrene in southern California mussels. Dunn, B.P. (Univ. of British Columbia, Vancouver); Young, D.R. *Mar. Pollut. Bull.;* 7: No. 12, 231-234(Dec 1976).

Marine mussels accumulate the carcinogen benzo(a)-pyrene from contaminated environments. Baseline studies in California indicate that levels of the carcinogen in mussels are at or near zero, except in areas of human activity. This finding runs counter to previous suggestions that benzo(a)pyrene is widely distributed in marine organisms.

7455 Lead in Port Phillip Bay mussels. Talbot, V. (La Trobe Univ., Victoria, Australia); Magee, R.J.; Hussain, M. *Mar. Pollut. Bull.;* 7: No. 12, 234-238(Dec 1976).

Lead levels in the indicator mussel Mytilus edulis exceed the WHO food standards in 19 of the 22 locations sampled in Port Phillip Bay, Melbourne. While this seriously reflects contamination of the food chain, LD_{50} experiments on Mytilus indicate that the lethal effect of lead on this organism is much less severe than excessive doses of mercury, cadmium, copper or zinc. Little is known about the long term effects of lead on Mytilus.

7456 Mercury content of mussels from the St. Lawrence estuary and Northwestern Gulf of St. Lawrence, Canada. Bourget, E.; Cossa, D. (SOUQAR, Quebec). *Mar. Pollut. Bull.;* 7: No. 12, 238-240(Dec 1976).

A first survey of the mercury content of intertidal mussels in the St. Lawrence Estuary and part of the Gulf of St. Lawrence shows mean values ranging from 0.160 to 0.629 ppM (dry weight). Highest values (grand mean 0.430 ppM) were found in the upper part of the lower estuary, lowest values (grand mean 0.172 ppM) on the north shore of the estuary and Gulf, and intermediate values along the Gaspe Peninsula. The results indicate a decreasing gradient in mercury levels from the mouth of the Saguenay Fjord seaward.

7457 Comparative survey of petroleum hydrocarbons in lake sediments. Wakeham, S.G. (Univ. of Washington, Seattle). *Mar. Pollut. Bull.;* 7: No. 11, 206-211(Nov 1976).

Hydrocarbon distribution in sediments from three lakes are related to the level of human activity in the respective drainage basins. Petroleum hydrocarbon contamination is found in surface sediments of a lake surrounded by a major city, compared to no detectable contamination in a lake located in a National Park.

7458 Barium build-up in the Teign Estuary. Merefield, J.R. (Univ. of Highfield, Eng.). *Mar. Pollut. Bull.;* 7: No. 11, 214-216(Nov 1976).

Accumulations of barium occur in the River Teign, in south-west England, and its estuary, largely in the form of barytes. These concentrations are derived from weathering in the Teign Valley orefield, an area of mineralization scattered with mine dumps. It appears that although barium values may increase in the upper confines of the estuary the net effect on lower reaches will be negligible.

7459 Interactions of lead with sediments and meiofauna. Roberts, D. (Queens Univ., Belfast); Maguire, C. *Mar. Pollut. Bull.;* 7: No. 11, 211-214(Nov 1976).

Harpactacoid copepods and Turbellaria appear to be the most sensitive faunal groups in surface sand meiofauna when subjected to contamination by lead; in subsurface sand, nematodes are found to be the most sensitive group. Simple laboratory attempts to assess lead partitioning in littoral sand gave variable results and the problems and merits of such experimental approaches are discussed.

7460 Assessment of the pollution of Cornish coastal waters. Bradfield, R.E.N.; Kingsbury, R.W.S.M.; Rees, C.P. (Atkins Research and Development, Surry, Eng.). *Mar. Pollut. Bull.;* 7: No. 10, 187-193(Oct 1976).

A detailed survey of pollution was undertaken in five areas around the Cornwall coast in south-west England, at St. Austell and Mevagissey Bays, Falmouth Bay, Mounts Bay, St. Ives Bay and Portreath. The aim of the study was to establish baseline values against which subsequent changes could be detected and their importance evaluated. Three major investigations were undertaken in each area involving seawater sampling and analysis, heavy metal analysis of seaweed specimens and quantitative surveys of intertidal fauna and flora. In general, the areas studied showed few signs of being exposed to significant levels of industrial or sewage pollution.

7461 (ORNL-tr—4445) **Sterilization of water by filtration through polarized materials.** Gvozdjak, P.I.; Skubko, T.P.; Shchuche'eva, A.V. Translated by S.D. Blalock from *Mikrobiol. Zh.;* No. 1, 40-43(1976). 5p. Dep. NTIS, PC A02/MF A01.

Effectivity of complete separation of microorganisms from desalted water when it passes through a polarized fibrous material was studied as affected by the electric and hydraulic parameters. It is established that the process of microorganism separation is determined mainly by the field intensity and rate of the liquid flow. The filtrating material packing as well as the microorganism nature is of definite significance. The boundaries of sterility and apyrogenicity zones of water are determined experimentally as dependent on the electric field intensity and the filter packing for the studied cells of microorganisms under different rates of filtration.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 7378, 7385, 7415, 7512

THERMAL EFFLUENTS MONITORING AND TRANSPORT

7462 (CONF-771046—1) **Prey selection by sauger in Watts Bar Reservoir, Tennessee, as affected by cold-induced mortality of threadfin shad.** McGee, M.V.; Griffith, J.S. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 20p. Dep. NTIS, PC A02/MF A01.

From Conference of the Association of Game and Fish Commissioners; San Antonio, Texas, USA (12 Oct 1977).

Prey selection by sauger (Stizostedion canadense) was monitored from November 1976 through March 1977 in the portion of Watts Bar Reservoir, Tennessee, near the Kingston Steam Plant. Threadfin shad (Dorosoma petenense) provided the entire forage base for sauger until the population of the former species was almost completely eliminated by low temperatures in December and January. Some sauger switched to alternate prey, but greater than 75% of stomachs in February-March were empty. Food consumption of sauger smaller than 30 cm in length was most severely restricted by the loss of forage. Digestive rate studies in the laboratory indicated

digestion continued at a reduced, but still effective, rate at temperatures less than 10 C.

7463 Sport fishing at a thermal discharge into Lake Michigan. Spigarelli, S.A.; Thommes, M.M. (Argonne National Lab., IL). *J. Great Lakes Res.;* **2**: No. 1, 99-110(Jul 1976).

Sport fishing censuses were conducted during 1972 and 1973 at the Point Beach Nuclear Plant on Lake Michigan (Two Rivers, Wisconsin). The objectives of this study were to describe the fishery at a typical shoreline thermal discharge into the upper Great Lakes and to make comparisons with reference fisheries in unheated areas. Extensive sport fishing at this power plant resulted in a relatively large catch of trout (4 species) and sporadic catches of salmon and non-salmonid species. Species composition of the catch and catch-per-unit-effort varied daily and seasonally and generally reflected trends in reference fisheries. A comparison between years showed increased fishing effort, total catch, and proportion of trout in 1973, while success (catch-per-unit-effort) decreased. Despite this heavy fishing pressure, catch-per-unit-effort was generally higher at Point Beach than in reference shoreline fisheries. The economic value of thermal discharge fisheries on Lake Michigan is estimated using available value and expenditure data.

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 5868, 7466

7464 (BNWL—2401) **Impingement studies at the 100-N reactor water intake.** Page, T.L.; Neitzel, D.A.; Gray, R.H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-06-1830. 37p. Dep. NTIS, PC A03/MF A01.

Fish impingement and traveling screen passage were studied at the 100-N reactor water intake structure, Columbia River mile 380, from late April to August 1977. Species and numbers of fish affected were determined and compared to those at the adjacent Hanford Generating Project (HGP). Fish protection procedures previously developed for HGP were evaluated for application at 100-N.

7465 (FE—2444-1) **Investigation of the potential for utilization of saline ground water in energy-related processes. Final report.** (Radian Corp., Austin, Tex. (USA)). May 1977. Contract EX-76-C-01-2444. 205p. Dep. NTIS, PC A10/MF A01.

The usability of saline water for coal gasification, liquefaction, and coal-fired power plants was evaluated. Water resources high in total dissolved solids (TDS) in western coal regions were identified. High TDS waters were defined as water containing more than 1500 mg/l of dissolved solids. The water systems of three coal gasification processes, two coal liquefaction processes, and a coal-fired power plant are described. Cooling water systems, ash sluicing systems, flue gas cleaning, and boiler feed water systems were studied to assess the potential for saline water substitution. Water consumption for the processes was determined from energy and mass balance calculations. A computer simulation of aqueous inorganic chemical systems was used to evaluate the impact of using various qualities of high TSD waters. It was concluded that high TDS ground waters are available in most western coal resource regions. Some surface water supplies high in TDS also exist in coal-producing regions. An assessment of the feasibiity of use of different high TDS waters revealed that TDS alone is not an adequate parameter for evaluation. Specific components in the water dictate usability of water and type and extent of treatment required. Ability to predict the aqueous inorganic chemistry of water systems is required to accurately assess the feasibility of water use.

REGULATIONS

REFER ALSO TO CITATION(S) 6944

ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 6423, 6429, 6438, 6443, 6874

SOCIAL AND ECONOMIC STUDIES

REFER ALSO TO CITATION(S) 6418, 6427, 6855, 6857, 6857, 6858, 6859, 6865, 6868, 7027

ASSESSMENT OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 6427, 6430, 6878, 6970, 7438

ENVIRONMENTAL IMPACT STATEMENTS

REFER ALSO TO CITATION(S) 6024, 6702

BIOMEDICAL SCIENCES, BASIC STUDIES

BEHAVIORAL BIOLOGY

REFER ALSO TO CITATION(S) 7462

7466 (COO—1332-129) **Vertebrate behavior and ecology. Progress report, July 1, 1976—June 30, 1977.** Tester, J.R.; Siniff, D.B. (Minnesota Univ., Minneapolis (USA)). Jul 1977. Contract EY-76-S-02-1332. 48p. Dep. NTIS, PC A03/MF A01.

Progress is summarized under six subprojects; engineering design and development; statistical procedures and quantitative methods for analysis of ecological and behavioral data; coexistence and population dynamics of selected vertebrates; application of radiotelemetry to selected problems in vertebrate censusing and population study; fish response to alterations in water quality resulting from power production; and seasonal migrations and habitat selection of the pronghorn antelope (Antilocapra americana).

7467 Trophic relationships in a seagrass community (Thalassia testudinum), in Card Sound, Florida. Fish diets in relation to macrobenthic and cryptic faunal abundance. Brook, I.M. (Univ. of Miami). *Trans. Am. Fish. Soc.;* **106**: No. 3, 219-229(May 1977).

Seagrass communities are a major feature of shallow marine areas throughout the world. The marine spermatophyte Thalassia testudinum is the dominant seagrass in southeast Florida and the Florida Gulf coast. The trophic interaction between the fishes and the macrobenthic and cryptic fauna found in the area was examined. Based on digestive tract analysis, the principal interaction between the primary consumers of the study area and the higher trophic level predators was via the polychaetes and peracaridean crustaceans. The mollusks which contributed significantly to the benthic biomass were not a preferred food for the animals frequenting the study site. The maximum mollusk biomass in any benthic and cryptic sample was 2.31 g dry/m^2. It was felt that the predator population was limited by the small stock of polychaetes and peracaridean crustaceans which had a maximum biomass in any one sample equivalent to 1.74 g dry/m^2. The majority of the fishes captured were foragers over a wide area. The main residents were the syngnathids and the gold-spotted killifish, Floridichthys carpio.

BIOCHEMISTRY

REFER ALSO TO CITATION(S) 7501, 7566, 7586, 7587

7468 (COO—875-177) **Photosensitization in biological systems.** Spikes, J.D. (Utah Univ., Salt Lake City (USA). Dept. of Biology). 1976. Contract EY-76-S-02-0875. 3p. (CONF-760861—2). Dep. NTIS, PC A02/MF A01.

From 7. international congress on photobiology; Rome, Italy (29 Aug 1976).

Our symposium examines the current status of our knowledge of the photosensitized reactions of nucleic acids and proteins. Significant advances have been made in this area of photobiology since the last international Congress. The first paper will explore the role of molecular oxygen in photosensitized reactions of proteins and nucleic acids. The last three papers are concerned primarily with photosensitized reactions of nucleic acids and their components in which the sensitizer is consumed by bonding covalently with the substrate on irradiation. The best understood reactions of this type are those sensitized by furocoumarins such as 5-methoxypsoralen. These sensitizers show promise in the photochemotherapeutic treatment of proliferative diseases of the skin, such as psoriasis.

7469 (COO—875-178) **Energy transfer mechanisms in photobiological reactions. Progress report, 1 August 1976—31 July 1977.** Spikes, J.D. (Utah State Univ., Logan (USA). Dept. of Biology). 31 Jul 1977. Contract EY-76-S-02-0875. 8p. Dep. NTIS, PC A02/MF A01.

Progress is reported on the following studies: chemical structure of biomolecules and mechanisms of their sensitized photooxidation; relationships between the structure and photosensitizing efficiencies of porphyrins; effects of photodynamic treatment on mammalian tendons; and sensitized photo-oxidation of substituted uracils, methionine, other amino acids, and horse-radish peroxidase. (HLW)

7470 SP-Sephadex equilibrium chromatography of bradykinin and related peptides: application to trypsin-treated human plasma. Sampaio, M.U.; Reis, M.L.; Fink, E.; Camargo, A.C.M.; Greene, L.J. (Brookhaven National Lab., Upton, NY). *Anal. Biochem.;* **81**: No. 2, 369-383(Aug 1977).

An analytical method is described for the separation of bradykinin. Lysbradykinin, and Met-Lys-bradykinin by equilibrium chromatography on SP-Sephadex C-25 eluted in 0.02 M Tris-HCl buffer, pH 8.10, 0.12 M NaCl. A second elution buffer, 0.02 M Tris-HCl buffer, pH 7.70, 0.06 M NaCl, serves as a second parameter for the identification of bradykinin and also separates the hormone from plasma bradykinin-potentiating peptides. Ten to one-hundred nanomoles of each peptide can be recovered in high yields, identified by elution position, and measured by bioassay with the isolated guinea pig ileum. The identification of bradykinin as the peptide released by trypsin acting on acid-denatured plasma is documented as an illustration of the method.

7471 Spin-reduction assay for lipoxidase. Snipes, W.; Kenny, K.; Keith, A. (Pennsylvania State Univ., University Park). *Anal. Biochem.;* **81**: No. 2, 425-431(Aug 1977).

Spin-label signals are reduced when the nitroxide is present in a lipoxidase reaction mixture. This spin reduction can be used as an assay for enzyme activity in turbid systems where the conventional uv assay cannot be used. Data taken with the spin-reduction assay show that phospholipid preparations containing cholesterol are more resistant to oxidation by lipoxidase than are cholesterol-free preparations.

7472 Conformational states of chromatin ν bodies induced by urea. Olins, D.E. (Oak Ridge National Lab., TN); Bryan, P.N.; Harrington, R.E.; Hill, W.E.; Olins, A.L. *Nucleic Acids Res.;* **4**: No. 6, 1911-1933(Jun 1977).

Monomer chromatin nu bodies (ν_1) from chicken erythrocyte nuclei were exposed to 0 to 10 M urea plus 0.2 mM EDTA (pH 7). Alterations in ν_1 conformation were examined using hydrodynamic methods (i.e., S, eta, and d rho/dc), thermal denaturation, circular dichroism, reactivity of histone thiol groups to N-ethyl maleimide, and electron microscopy. The two domains of a ν body (i.e., the DNA-rich shell and the protein-rich core) appeared to respond differently to the destabilizing effects of increasing urea: DNA conformation and stability exhibited noncooperative changes; the core protein structure revealed cooperative destabilization between 4 and 7 M urea. Companion studies on the conformation of the inner histone "heterotypic tetramer" also revealed cooperative destabilization with increasing urea concentration.

7473 Effect of heavy metals (lead, cadmium and mercury) upon oleyl-CoA desaturase. Mazliak, P.; Decotte, A.M.; Kader, J.C. (Laboratoire de Physiologie Cellulaire, Paris). *Chem.-Biol. Interact.;* **16**: No. 1, 115-119(Jan 1977).

The effects of three heavy metals (lead, cadmium and mercury) upon the oleyl-CoA desaturase from potato tubers were studied. Potato tuber slices were put floating on the surface of an aqueous solution of $CaSO_4$ at 25°C, for 18 h. The solution was aerated by agitation. Microsomes were extracted from aged potato slices and oleyl-CoA desaturase activity was assayed. Similar test tubes were prepared with various quantities of a heavy metal acetate. The desaturation reactions were stopped by pouring into each tube 5 ml of aqueous NaOH. Results showed that the oleyl-CoA desaturase activity is altered by the presence of heavy metals in the desaturation medium. Mercury was clearly an inhibitor of the oleyl-CoA desaturase activity. The inhibition increased with increasing concentrations of the metal in the desaturation medium, up to 20 to 50 ppM. Above these concentrations no desaturation at all could be observed. Lead and cadmium were far less inhibitory for oleyl-CoA desaturase and such high concentrations as about 100 ppM of both metals in the desaturation medium did not diminish the desaturation activity more than 40% as compared to standard. At very low concentrations (<15 ppM) the cadmium was even stimulatory for the oleyl-CoA desaturase whereas lead produces a 50% inhibition of the activity of the enzyme.

7474 Purification and identification of a cytokinin from moss callus cells. Beutelmann, P. (Plant Research Lab., East Lansing, MI); Bauer, L. *Planta;* **133**: No. 3, 215-217(1977).

A cytokinin was isolated from the culture medium of callus cells of the moss hybrid Funaria hygrometrica (L.) Sibth x Physcomitrium piriforme Brid. The purification procedure included ethylacetate extraction, silver-salt precipitation, crystallization as picrate, and ion exchange chromatography. The structure of the cytokinin was confirmed as N^6-(Δ^2-isopentenyl)adenine by means of gas chromatography and mass spectrometry. The concentration of the compound in the culture medium was determined at ca. 10^{-6} M.

7475 Crystal and molecular structure of carbamate insectides. III. Methomyl. Takusagawa, F.; Jacobson, R.A. (Ames Lab., IA). *J. Agric. Food Chem.;* **25**: No. 3, 577-581(1977).

The crystal and molecular structure of methomyl (S-methyl N-[(methylcarbamoyl)oxy] thioacetimidate) has been determined by three-dimensional x-ray analysis. It crystallizes in the monoclinic space group $P2_1/n$ with cell dimensions a = 13.996 (6), b = 9.678 (3), c = 6.096 (2) A, and β = 91.45 (4)°. The structure was solved by the heavy-atom technique and refined by full-matrix least-squares procedures to a final discrepancy factor R = 0.054 for 888 observed reflections. The molecule is approximately planar, and the moieties are weakly hydrogen bonded to one another along the b direction. The C-O single bond length was found to be somewhat lengthened (1.371 A) relative to the equivalent distance found in carboxylic acids. Comparison of the general features of the carbamate group in methomyl, aldicarb, and Mesurol suggest a possible correlation of both C-O single bond distance and angle opposite the doubly bonded oxygen with LD_{50} values. Results of CNDO molecular orbital calculations are also given for these three carbamate insecticides.

7476 Photochemistry and photobiology of ribonucleic acids, ribonucleoproteins, and RNA viruses. Gordon, M.P.; Huang, C.; Hurter, J. pp 265-308 of In Photochemistry and photobiology of nucleic acids. Vol. II. Biology. New York; Academic Press, Inc. (1976).

Studies on the photochemistry and photobiology of RNA, ribonucleoproteins, and RNA viruses are reviewed under the following headings: chemical nature of lesions introduced into viral RNA by uv light; factors influencing the quantum yield of inactivation; the photochemistry and photobiology of specific viruses and their RNAs; photoreactivation and repair processes; and effects of uv on components of protein synthesizing systems. (HLW)

7477 Mechanism of erythropoietin-induced differentiation. XIV. The apparent effect of etiocholanolone on initiation of erythropoiesis. Gross, M.; Goldwasser, E. (Univ. of Chicago). *Exp. Hematol.;* **4**: 227-233(1976).

Etiocholanolone, when tested in normal mice or in mice that have been out of an hypoxic atmosphere for only a few days, stimulates erythropoiesis, but appears to have no effect on erythropoiesis when tested in plethoric mice that have very low residual red cell formation. The steroid, similarly, stimulates hemoglobin synthesis by marrow cells in culture if they are from normal mice, but has no effect on cells from transfused mice. Our data suggest that 5 β-H androstane and pregnane derivatives do not have a primary action on the induction of erythropoiesis, but act on cells that are already differentiated.

7478 III. Complete amino acid sequence of the V/sub H/ region of the IgM paraprotein. Capra, J.D.; Hopper, J.E. (Univ. of Texas Health Science Center, Dallas). *Immunochemistry;* **13**: 995-999(1976).

Two paraproteins (IgM lambda, IgG3 kappa) obtained from a single individual's sera had been previously shown to possess highly similar, if not identical idiotypic determinants. Preliminary structural analysis indicated that the mu and gamma chains belonged to different heavy chain variable region subgroups. Since there is abundant evidence that there is a relationship between the structure of hypervariable regions of immunoglobulin polypeptide chains and their idiotypic specificities, these findings would suggest that this pair of paraproteins may contain one or more identical hypervariable regions within different framework sequences. To test this possibility, their complete amino acid sequence is being undertaken. This publication describes the sequence of the variable region of the mu chain of this pair of paraproteins and brings to 10 the total number of completely sequenced human V/sub H/III proteins.

7479 Interactions with insulin and dexamethasone in net synthesis of albumin and acute-phase proteins. Miller, L.L. (Univ. of Rochester, NY). *Diabetes;* **25**: No. Suppl. 2, 865-871(1976).

The isolated rat liver perfused for 12 hours at pH 7.10 with a suspension of bovine erythrocytes in Krebs—Ringer bicarbonate buffer containing 3% bovine serum albumin has been used as a test system to study effects of glucagon and of dexamethasone in the presence and absence of insulin on net biosynthesis of rat serum albumin, fibrinogen, α_1-acid glycoprotein, α_2-(acute phase) globulin, and haptoglobin. Quantitative measurement of perfusate glucose, amino acid nitrogen, and urea affords a basis for determining net glucose and nitrogen balance in the perfusion system. Although the dose of dexamethasone (total 1.0 μg) used was insufficient to induce synthesis of α_2-acute phase globulin, net syntheses of albumin, fibrinogen, α_1-acid glycoprotein, and haptoglobin were increased. Glucagon given with dexamethasone depressed albumin and haptoglobin synthesis markedly, but not that of fibrinogen and α_1-acid glycoprotein. Glucagon with dexamethasone markedly enhanced ureogenesis and glycogenolysis and elicited an exaggerated negative nitrogen

balance. The unfavorable effects of glucagon on albumin and haptoglobin synthesis and on nitrogen balance were reversed by giving insulin simultaneously. It is emphasized that insulin is essential for positive nitrogen balance.

7480 Phleomycin-induced lethality and DNA degradation in Escherichia coli K12. Nakayama, H. (Stanford Univ., CA). *Mutat. Res.;* **29**: 21-33(1975).

The cell lethality and DNA fragmentation caused by phleomycin (PM) were studied in E. coli K12 strains with special reference to the effects of repair or recombination deficiencies and metabolic inhibitors. Unlike excision-defective derivatives of E. coli B, uvrA, uvrB, and uvrC mutants of strain K12 showed no peculiarities compared with wild type in regard to cell survival. Likewise, mutant alleles at uvrD and polA loci had no effect. In contrast, rec mutants were more sensitive to PM-killing than were rec^+ strains. PM-induced strand breakage in DNA was observed in all strains tested including the above-mentioned mutants. There was no significant distinction between the uvr mutants and the wild type strain, indicating that the uvr-endonuclease was not responsible for the strand breaks. Involvement of endonuclease I was also ruled out. At least some of the PM-induced strand breaks were repairable. PM-induced lethality and strand breakage were totally dependent on energy supply. Inhibition of protein synthesis resulted in a partial and parallel suppression of the two effects. Our results suggest that the lethality is due to DNA strand breakage and the repair of such damage is postulated to be controlled by rec genes.

CYTOLOGY

REFER ALSO TO CITATION(S) 7472

7481 Partial deletion of long arm of chromosome 17. Golomb, H.M. (Univ. of Chicago, IL); Rowley, J.; Vardiman, J.; Baron, J.; Locker, G.; Krasnow, S. *Arch. Intern. Med.;* **136**: 825-828(Jul 1976).

Two patients with acute promyelocytic leukemia had an identical chromosomal abnormality detected by fluorescence banding. In each case, the clinical course was rapidly fatal, and was characterized by a lack of response to chemotherapy with cytarabine and thioguanine, and was complicated by disseminated intravascular coagulation. Bone marrow cells from each patient contained 46 chromosomes; in each instance, however, one chromosome 17 had a deletion of almost one half of the proximal portion of the long arm [del(17)(q11q21 or 22)].

GENETICS

REFER ALSO TO CITATION(S) 7488

7482 Substitution of serine caused by a recessive lethal suppressor in yeast. Brandriss, M.C. (Massachusetts Inst. of Tech., Cambridge); Stewart, J.W.; Sherman, F.; Botstein, D. *J. Mol. Biol.;* **102**: 467-476(1976).

The SUP-RL1 suppressor in the yeast Saccharomyces cerevisiae causes lethality in haploid strains but not in diploid or aneuploid strains that are heterozygous for the suppressor locus. This recessive lethal suppressor acts on amber (UAG) nutritional markers, and can cause the production of approximately 50% of the normal amount of iso-1-cytochrome c in disomic strains that are heterozygous for the SUP-RL1 suppressor, and that contain the cyc1-179 allele which has an amber codon corresponding to amino acid position 9. The suppressed iso-1-cytochrome c contains a residue of serine at the position that corresponds to the site of the amber codon. SUP-RL1 was found to lie between thr4 and MAL2 on chromosome III, approximately 30 map units from the mating-type locus. It is suggested that the gene product of SUP-RL1 may be a species of serine transfer RNA that normally reads the serine codon UCG, and that is represented only once in the haploid genome.

7483 Evolution of mammalian carbonic anhydrase loci by tandem duplication: close linkage of Car-1 and Car-2 to the centromere region of chromosome 3 of the mouse. Eicher, E.M. (Jackson Lab., Bar Harbor, ME); Stern, R.H.; Womack, J.E.; Davisson, M.T.; Roderick, T.H.; Reynolds, S.C. *Biochem. Genet.;* **14**: No. 7/8, 651-660(1976).

Electrophoretic variants of two carbonic anhydrase enzymes, CAR-1 (CA I) and CAR-2 (CA II), have been found in the laboratory mouse, Mus musculus. These two loci are closely linked to each other and are located on chromosome 3 near its centromere. The close linkage of Car-1 and Car-2 supports the hypothesis that the present-day carbonic anhydrase loci are the result of tandem duplication of an earlier carbonic anhydrase locus with subsequent divergence. The red blood cells of mice of the subspecies M. m. casteneus have significantly reduced levels of CAR-1 and CAR-2.

METABOLISM

REFER ALSO TO CITATION(S) 7561, 7562, 7586, 7589, 7599

7484 (UR—3490-1204) **Net C3 complement synthesis in the isolated perfused rat liver system.** Burday, M.S. (Rochester Univ., N.Y. (USA)). 1977. Contract EY-76-C-02-3490. 228p. Dep. NTIS, PC A11/MF A01.

Up until now complement synthesis in vitro has been followed mainly by using one of two systems: cell culture or tissue slices. In this investigation C3 biosynthesis was demonstrated using an isolated perfused rat liver system with a radial immunodiffusion assay to follow C3 accumulation. For comparison perfusion sample values were standardized to 300 cm^2 body surface area. C3 is an acute phase protein whose levels are known to rise as the result of stress. In addition to stimulating other endocrine glands, stress is known to stimulate the pituitary-adrenal system resulting in elevated glucocorticoid levels. The purpose of this study was to investigate the relationship between inflammation, various glucocorticoid hormones, growth hormone, and C3 synthesis and to investigate the mechanism of the induction of C3 synthesis. That the accumulation of C3 in the isolated perfused liver system was the result of de novo synthesis was indicated by the inhibition of its synthesis with the inhibitors actinomycin D, cordycepin and puromycin. With the addition of puromycin at the outset of perfusion the release of preformed C3 ceased after 2 hours.

7485 Trichloroethylene. I. An overview. Waters, E.M.; Gerstner, H.B.; Huff, J.E. (Oak Ridge National Lab., TN). *J. Toxicol. Environ. Health;* **2**: No. 3, 671-707(Jan 1977).

Trichloroethylene (TCE) has been an industrial chemical of some importance for the past 50 years. First synthesized by Fischer in 1864, TCE has been used as a degreaser, and as an inhalation anesthetic and analgesic. The TCE overview provides a survey of the reference literature including history, nomenclature, physical and chemical properties, manufacture, analysis, uses, metabolism, toxicology, carcinogenic potential, exposure routes, recommended standards, and conclusions. Chemically, TCE is a colorless, highly volatile liquid of molecular formula C_2HCl_3. Autoxidation of the unstable compound yields acidic products. Stabilizers are added to retard decomposition. TCE has highly effective fat-solvent properties. Metabolically, TCE is transformed in the liver to trichloroacetic acid, trichloroethanol, and trichloroethanol glucuronide; these breakdown products are excreted through the kidneys. Most toxic responses occur as a result of industrial exposures. TCE affects principally the central nervous system (CNS). Short exposures result in subjective symptoms such as headache, nausea, and incoordination. Longer exposures may result in CNS depression, hepatorenal failure, and increased cardiac output. Cases of sudden death following TCE exposure are generally attributed to ventricular fibrillation. Current interest in TCE has focused on recent experimental data that implicate TCE as a cause of hepatocellular carcinoma in mice. No epidemiological data are available that demonstrate a similar action in humans. The overall population may be exposed to TCE through household cleaning fluids, decaffeinated coffee, and some spice extracts. The NIOSH recommended standard for TCE is 100 ppM as a time-weighted average for an 8-hr day, with a maximum allowable peak concentration of 150 ppM for 10 min.

7486 T- and B-lymphocyte chimerism in the marmoset. Niblack, G.D.; Kateley, J.R.; Gengozian, N. (Oak Ridge Associated Universities, TN). *Immunology;* **32**: 257-263(1977).

Marmosets are natural blood chimeras, this condition resulting from the high frequency of fraternal twinning and the consistent development of placental vascular anastomoses between the two embryos. Identification of chimerism by sex-chromosome analysis of cultured blood lymphocytes provided a means of determining the proportion of chimerism among T and B lymphocytes. Peripheral blood lymphocytes were enriched for T or B cells by filtration through a nylon column (yields >95% T-cells) or inactivation of T lymphocytes by treatment with a goat anti-marmoset thymocyte antiserum in the presence of complement (yields >95% B cells). Mitogenic stimulation of these separated, enriched cell populations yielded metaphase plates which could be scored for percentage male and female cells. Tests on five different blood chimeras showed the T- and B-lymphocyte chimerism to be the same. Stimulation of blood lymphocytes with cells from another species of marmoset in a mixed lymphocyte culture test revealed the chimeric T-cell response (i.e., host and co-twin cells) to be similar to that obtained with a mitogenic lectin. The demonstration of equivalent T- and B-cell chimerism in these animals suggests derivation of these cells from a common stem cell pool and the response of both T-cell populations to an antigenic stimulus in proportions similar to their percentage chimerism suggests complete immunologic tolerance exists in this species for co-twin histocompatibility antigens.

7487 Acute leukemia during reproductive life: its course, complications, and sequelae for fertility. Bitran, J.D.; Roth, D.G. (Univ. of

Chicago Cancer Research Center). *J. Reprod. Med.;* **17**: No. 4, 225-231(Oct 1976).

Acute leukemia is less common during the reproductive years than in children or in postmenopausal women. Effective chemotherapy exists for adult lymphocytic leukemia, and the median survival is 18 to 20 months. Acute myelogenous leukemia still has a less favorable prognosis, with a medial survival of 12 months despite effective chemotherapeutic agents. The occurrence of acute leukemia in pregnancy does not change the overall prognosis, which depends primarily on the cytopathologic types. If leukemia occurs during the first trimester, therapeutic abortion is advised since the rate of spontaneous abortion after chemotherapy is high in the first trimester and fetal malformations are common. Acute leukemia can be treated in the second and third trimesters with little effect on the pregnancy or fetus. In patients cured of acute leukemia, the potential for subsequent pregnancies exists with little likelihood of increases in fetal malformations.

TRACER TECHNIQUES

7488 (SRO—643-14) **RNA metabolism in the regulation of protein synthesis in plants. Progress report summary, July 1976—August 1977.** Key, J.L. (Georgia Univ., Athens (USA)). Sep 1977. Contract EY-76-S-09-0643. 12p. Dep. NTIS, PC A02/MF A01.

Results are reported from studies on the isolation and characterization of polyadenylated RNA from soybean suspension culture cells. This RNA fraction, when isolated from total RNA or from polysomes after short ^{3}H-uridine labeling periods (.5 to 3 hr), was found to be similar to poly (A) RNA from soybean hypocotyl sections in several respects. Poly (A) RNA isolated from total cell RNA was used in hybridization experiments to determine the sequence complexity of the poly (A) RNA and to determine whether it is transcribed from unique or repeat portions of the soybean DNA.

7489 **Glucose turnover in kelp bass (Paralabrax sp.): in vivo studies with [6-^{3}H,6-^{14}C]glucose.** Bever, K.; Chenoweth, M.; Dunn, A. (Univ. of Southern California, Los Angeles). *Am. J. Physiol.;* **1**: No. 1, 66-72(Jan 1977).

[6-^{3}H,6-^{14}C]glucose was injected via an indwelling arterial cannula in free-swimming, fed, and fasted kelp bass to determine hepatic glucose production, peripheral glucose uptake, minimal glucose mass, mean transit time, and the percent of carbon recycling under the two different nutritional states. Mean plasma glucose levels remained unchanged in fed and fasted fish (48 +- 8 vs. 43 +- 8 mg/100 ml). During steady-state conditions, glucose replacement rates of fed and fasted fish determined with [6-^{3}H]glucose are similar (0.035 +- 0.006 vs. 0.025 +- 0.003 mg/min per 100 g) and do not differ from rates determined with [6-^{14}C]glucose (0.035 +- 0.005 vs. 0.026 +- 0.002). The minimal glucose masses and the mean transit times determined with both isotopes are also similar suggesting that plasma glucose levels and glucose turnover are maintained in fish fasted up to 40 days with no apparent increase in carbon recycling. Nonsteady-state isotope experiments suggest that these fish can alter rates of hepatic glucose production and peripheral uptake in response to hyper- and hypoglycemia.

7490 **Fate of petroleum hydrocarbons taken up from food and water by the blue crab Callinectes sapidus.** Lee, R.F.; Ryan, C.; Neuhauser, M.L. (Skidaway Inst. of Oceanography, Savannah). *Mar. Biol.;* **37**: No. 4, 363-370(Sep 1976).

Radiolabeled paraffinic and aromatic hydrocarbons, including benzopyrene, fluorene, naphthalene, methylnaphthalene, methylcholanthrene, hexadecane, heptadecane and dotriacontane, were taken up from food and water by the blue crab Callinectes sapidus. In 2 days, approximately 10% of the benzopyrene and fluorene were taken up from the water when their concentrations were 2.5 and 30 μg/1, respectively. When given food with radiolabeled hydrocarbons, 2 to 10% of the hydrocarbons were assimilated by the crabs, with the remainder excreted. After uptake of hydrocarbon from water or food, a major pathway for the elimination of hydrocarbon and metabolites was through fecal material. All hydrocarbons used in the study were metabolized, with similar rates for both paraffinic and aromatic hydrocarbons. More than 50% of the radioactivity assimilated by the crabs was in the hepatopancreas, suggesting that the hepatopancreas was the site of hydrocarbon metabolism. Twenty-five days after exposure to radiolabeled hydrocarbons, radioactivity was found only in the hepato-pancreas. The hepatopancreas contained highly polar hydrocarbon metabolites, including dihydroxy-compounds and their conjugates, while blood contained both monohydroxy- and dihydroxy-compounds. No evidence was found of storage of hydrocarbons by any of the crab tissues.

MEDICINE

TRACER TECHNIQUES

REFER ALSO TO CITATION(S) 7290, 7291

7491 (FDA—77-8035) **Developing role of short-lived radionuclides in nuclear medicine.** (Bureau of Radiological Health, Rockville, Md. (USA)). Aug 1977. 66p. of Radiological Health, Rockville, MD.

This report recommends support of research in the methods of production, distribution, biomedical application and cost effectiveness of a number of accelerator produced and short-lived radionuclides by agencies of the Federal Government. These nuclides, although somewhat difficult to produce and distribute have the potential to provide improved diagnostic information with lower radiation dose when compared to the more conventional radiopharmaceuticals currently in use. Utilizing radioiodine-123 as the principal model and citing new uses for other radionuclides, the report presents information to substantiate a series of recommendations. A brief summary outlines the important forthcoming methodologies which will be required to justify the continuing use of these radionuclides in nuclear medicine and consideration of their growth and benefits.

7492 (STI/PUB—440(Vol.1)) **Medical radionuclide imaging. Proceedings series. Volume I.** (International Atomic Energy Agency, Vienna (Austria)). Apr 1977. 618p. (CONF-761060—P1). IAEA $43.00.

From IAEA symposium on medical radionuclide imaging; Los Angeles, California, United States of America (USA) (25 Oct 1976).

Sixty-eight papers discuss new instruments and techniques for medical radionuclide imaging. Topics discussed in detail include radiation detectors and scanning instruments, data processing, quality control and image evaluation, and radionuclide tomography.

7493 (STI/PUB—440(Vol.2)) **Medical radionuclide imaging. Proceedings series. Volume II.** (International Atomic Energy Agency, Vienna (Austria)). Jun 1977. 480p. (CONF-761060—P2). IAEA $33.00.

From IAEA symposium on medical radionuclide imaging; Los Angeles, California, United States of America (USA) (25 Oct 1976).

Fifty-nine papers discuss radiopharmaceuticals and diagnostic applications in scanning patients, with emphasis on cardiology. Data are included on the internal absorbed dose in various tissues from administered radiopharmaceuticals.

MICROBIOLOGY

REFER ALSO TO CITATION(S) 7480, 7543, 7544, 7545, 7558, 7560

MORPHOLOGY

REFER ALSO TO CITATION(S) 7496, 7497

PATHOLOGY

REFER ALSO TO CITATION(S) 7485, 7560, 7586

7494 (CONF-770832—1) **Diseases of white-tailed deer. Chapter 5. Neoplasia.** Cosgrove, G.E.; Satterfield, L.D.; Nettles, V.F. (Oak Ridge National Lab., Tenn. (USA); Georgia Univ., Athens (USA). Southeastern Cooperative Wildlife Disease Study). 1977. Contract W-7405-ENG-26. 20p. Dep. NTIS, PC A02/MF A01.

From 2. national symposium on diseases of white-tailed deer; Athens, Georgia, USA (8 Aug 1977).

Data on the occurrence and etiology of neoplasms in native populations of white-tailed deer are reviewed. Cutaneous fibromas, non-progressive lesions considered to be of viral etiology, are discussed in detail. The clinical signs associated with other benign and malignant neoplasms are discussed briefly. 30 references.

7495 **Effect of lymphoma and other neoplasms on hepatic and plasma enzymes of the host rat.** Herzfeld, A.; Greengard, O. (New England Deaconess Hospital, Boston). *Cancer Res.;* **37**: 231-238(Jan 1977).

Considerable thymidine kinase and pyrroline-5-carboxylate reductase activities were found in the plasma of rats bearing a transplanted lymphoma; neither activity was detected in plasma of hosts carrying hepatic, renal, mammary, or submaxillary gland tumors. All host livers exhibited signs of biochemical immaturity as indicated by the appropriate increases or decreases in the concentrations of the nine enzymes measured. The extent and time schedule of the changes in host liver varied with the enzyme and with the tumor that caused them. The hepatic concentrations of ornithine aminotransferase, arginase, pyrroline-5-carboxylate reductase, and glucokinase (all diminished), and of peptidyl proline hydroxylase and

hexokinase (increased) were sensitive indicators of tumor growth in general. The concentration of ornithine aminotransferase decreased before the tumors became palpable. At more advanced stages, the high hepatic thymidine kinase activity distinguished the presence of hepatoma and lymphoma from those of all other equally fast-growing tumors. However, only in lymphoma-bearing rats did a fivefold elevation of hepatic thymidine kinase occur as early as 4 days after implantation. Additional observations on the lymphoma itself, on blood cells, and on the involuting thymus of normal rats indicate that the striking systemic effects of this tumor cannot be explained by a release of enzymes from the thymus or by the increased number of lymphoma cells present in blood or liver.

PHYSIOLOGICAL SYSTEMS

REFER ALSO TO CITATION(S) 7551, 7552, 7585, 7586

7496 (LF—56, pp 126-130) **Tracheobronchial anatomy: species differences in branching patterns.** Schum, G.M.; Duggan, M.T.; Yeh, H.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Analysis of morphometric data collected on replica casts of the conducting airways of man and several animals used in inhalation toxicology has revealed important anatomical differences in the pattern of branching of the airway segments. Two basic types of branching patterns are suggested. Dogs and rodents have a strongly monopodial branching scheme with the major daughter at a bifurcation oriented along the same axis as the parent segment and with nearly the same diameter. The minor daughter is usually much smaller and is not on the main stem axis. In man, the pattern is a dichotomous scheme with daughter segments nearly the same in size and angular orientation. At any given branching division, dichotomous patterns have more segments than monopodial patterns. This may relate to differences in breathing patterns between man and dogs or rodents.

7497 (LF—56, pp 131-134) **Hypothesis for branching schemes in biological tree structures.** Yeh, H.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Biological tree structures, such as mammalian tracheobronchial trees, are complicated branching systems. One problem in modeling such systems is the determination of the number of segments at a given division along the tree. A hypothesis was proposed which has successfully been used in modeling the mammalian lung airways.

7498 (LF—56, pp 135-136) **Development of a parallel impactor.** Roberts, J.W.; Barr, E.B.; Yeh, H.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

To simulate aerosol deposition in the nasopharyngeal region of the human respiratory tract, it is desirable to design an impactor with special collection characteristics. A parallel impactor designed for this purpose is described and its collection characteristics are shown.

7499 **Method for continuous in vivo measurement of hemolymph conductivity in crabs.** Engel, D.W. (Atlantic Estuarine Fisheries Center, Beaufort, NC); Nichols, C.D. *J. Exp. Mar. Biol. Ecol.;* **26**: No. 2, 203-209(Feb 1977).

A miniaturized conductivity measuring device has been developed to monitor in vivo hemolymph conductivity in crabs. The device measures the conductivity by means of implanted platinum electrodes, and transmits the data via radiotelemetry to a receiving station through 6 ft of water. Crabs used in these investigations survived the insertion of the conductivity probe and appeared to behave and feed normally for up to one week with the probe in position. Blue crabs, Callinectes sapidus Rathbun, which were acclimated to either 5 or 35‰ were abruptly transferred to 35 and 5‰, respectively and the rate of change of hemolymph conductivity successfully monitored. The time required for the conductivity (ionic composition) change in the hemolymph of the crabs after transfer varied from 12 to 16 h for crabs transferred from 35 to 5‰ to less than an hour when the change was from 5 to 35‰.

AGRICULTURE AND FOOD TECHNOLOGY

REFER ALSO TO CITATION(S) 6867, 6885, 6978, 7053, 7435, 7569

BIOMEDICAL SCIENCES, APPLIED STUDIES

RADIATION EFFECTS

7500 **Field desorption mass spectrum of glucagon.** Winkler, H.U.; Beuhler, R.J.; Friedman, L. (Brookhaven National Lab., Upton, NY). *Biomed. Mass Spectrom.;* **3**: 201-206(1976).

A low resolution, high sensitivity study has been made of the field desorption mass spectrum of glucagon, a 29 amino acid residue underivatized peptide. The highest molecular weight fragments observed, when spectra were taken under conditions which minimized surface reactions of the peptide on the emitter, were found to contain no more than 18 amino acid residues. The most probable fragmentation processes for ions larger than m/e 600 were the production of fragments containing 10, 11, or 12 amino acid residues.

RADIATION EFFECTS ON BIOCHEMICALS

IN VITRO

REFER ALSO TO CITATION(S) 7468

7501 (TID—27764) **Molecular basis for the mutagenic and lethal effects of ultraviolet irradiation. Progress report.** (Johns Hopkins Univ., Baltimore, Md. (USA)). 1977. Contract EY-76-S-02-2814. 8p. Dep. NTIS, PC A02/MF A01.

Pathways of DNA repair in bacteria and mammalian cells. Progress is reported on the following studies: genetic control of incision and excision in Escherichia coli; effects of binding proteins on the repair process in vitro; location of endonuclease - uv-irradiated DNA complexes; identification of eukaryotic repair mechanisms; nuclear complementation in HeLa cells; enzyme isolation from repair syndrome skin fibroblasts; and expression of the E. coli - SV40 hybrid DNA. (HLW)

RADIATION EFFECTS ON CELLS

EXTERNAL SOURCE

7502 **CHORD operators for cell-survival models and insult assessment to active bone marrow.** Jones, T.D. (Oak Ridge National Lab., TN). *Radiat. Res.;* **71**: No. 2, 269-283(Aug 1977).

Critical Human Organ Radiation Dosimetry (CHORD) probability density functions for A—P (anterior-posterior), P—A (posterior-anterior), bilateral, rotational, and isotropic radiation environments serve as insult-attenuation operators for cell-survival models based on target theory or the prediction of primary lesions according to the dual theory of radiation action. CHORD distributions plus simple depth-dose data also permit the rapid estimation of the insult profile and the mean insult to the active bone-marrow system of a mathematical analog of the ICRP Reference Man. The CHORD concept follows the variations in the microscopic processes of absorption, attenuation, and scattering on a macroscopic level so that it is not necessary to attempt detailed original calculations for each and every case of interest. Similar techniques have been applied to reactor-criticality calculations and the general logic of the CHORD process can be applied to any cause-response type situation which can be described in terms of variation with distance in the medium of interest. Doses to active bone marrow from exposures to photons and neutrons are presented and excellent agreement is shown with the available experimental results.

RADIATION EFFECTS ON MICROORGANISMS

BASIC STUDIES

REFER ALSO TO CITATION(S) 7543

7503 **Radiation sensitivity of T1 bacteriophage on various host strain mutants of Escherichia coli.** Fluke, D.J. (Duke Univ., Durham, NC). *Radiat. Res.;* **71**: No. 2, 406-412(Aug 1977).

A comparison of four host strains for assay of dry T1 phage plaque survival indicates that about 25% of fast electron direct action damage expressed in $uvrB^-$ hosts is repaired in $uvrB^+$ hosts. The repair is not associated with a lex or err gene. In relative amounts, the uvr-repairable damage corresponds with that reported for the T1 phage irradiated by x rays in heavily protected anoxic suspension and assayed for plaque survival on uvr^+ and uvr^- host strains.

RADIATION EFFECTS ON ANIMALS

MAN

7504 (LA-UR—77-2053) **Computer system for radiation therapy with negative pions.** Helland, J.A.; Kittell, R.S. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 6p. (CONF-770962—1). Dep. NTIS, PC A02/MF A01.

From 6. international conference on the use of computers in radiation therapy; Goettingen, F.R. Germany (18 Sep 1977).

Since 1974 Cancer Therapy Research has been conducted at the Clinton P. Anderson Meson Physics Facility, Los Alamos Scientific Laboratory, Los Alamos, New Mexico using negative pimesons. Through 1977 all treatments will have been static scan treatments, during which a DEC PDP-11/45 computer was used to monitor, record and verify channel and treatment parameters. This computer system has an RSX-11D operating system, and communicates with hardware via CAMAC. Beginning in 1978, dynamic scan treatments will commence and the patient will be moving during the treatment. A PDP-11/03 microprocessor will be used to move the patient in three dimensions and one rotation, and to control beam-modification devices such as slit jaws and a variable-thickness range shifter. Simultaneously the treatment will be monitored and verified by the PDP-11/45 computer.

7505 (ORNL/TM—5873) **In-phantom spectrometry of medical diagnostic x rays.** Stansbury, P.S. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 235p. Dep. NTIS, PC A11/MF A01.

A program of measurements was made to determine the spectral fluence distributions at locations of significance in a heterogeneous, hominoid phantom exposed to x rays in a manner simulating medical diagnostic radiology. The measurements were made with a specially constructed NaI(Tl) scintillation detector. The detector had a spherically shaped active volume 0.6 cm in diameter. The resolution of this detector was five times worse than that of a more conventional NaI(Tl) spectrometer. Resolution broadening and other distortions were removed from the observed pulse height spectra with a computer-coded, iterative unfolding technique. The performance of the spectrometer and the unfolding scheme was assessed by comparing, in a few cases, the unfolded NaI(Tl) spectra with spectra determined with a high resolution Ge(Li) spectrometer. The measurements were made in a physical model of an idealized representation of an average adult patient.

7506 **Results of involved field and extended field radiotherapy in patients with pathologic stage I and II Hodgkin's disease.** Miller, J.B. (Univ. of Chicago); Moran, E.M.; Dresser, R.K. Griem, M.L.; Ultmann, J.E. *Am. J. Roentgenol.;* **127**: 833-839(1976).

A series of 44 previously untreated patients was found to have stage I or II Hodgkin's disease on the basis of a diagnostic workup which included laparotomy and splenectomy in 39 cases. The patients were randomized to either involved field or extended field radiotherapy. No difference was found in overall survival rates between the two groups. Regional recurrences were seen in four patients in the involved field group and in none of the extended field group. Radiotherapy to the extended field treatment port (generally an extended mantle) can be given with acceptable side effects. Staging laparotomy was of definite value, changing the classification and resulting therapy of two groups: patients with clinical stage (CS) I or II, pathologic stage (PS) III involvement, who were treated with appropriately larger radiotherapy fields; and patients with CS III, PS I or II, who were spared unnecessarily extensive radiotherapy.

VERTEBRATES

7507 (BNL—23239) **Amazon Molly, Poecilia formosa, as a model for studies of the effects of ionizing radiation.** Woodhead, A.D.; Setlow, R.B.; Hart, R.W. (Brookhaven National Lab., Upton, N.Y. (USA); Ohio State Univ., Columbus (USA). Dept. of Radiology). 1977. Contract EY-76-C-02-0016. 26p. (CONF-771115—1). Dep. NTIS, PC A03/MF A01.

From Advisory group on methodology of radiation effects experiments on aquatic organisms and ecosystems for evaluation; Vienna, Austria (21 Nov 1977).

It is suggested that the viviparous teleost, Poecilia formosa, (Amazon molly) may have wide potential use for aquatic radiation studies. The Amazon molly is a naturally occurring gynogenetic species, in which the eggs are activated after mating with the males of closely related species, without the subsequent genetic contribution from the male. The offspring of a single original female constitute a clone, having identical genotypes. Clones of the genetically homogeneous Amazon molly may prove to be equally as valuable to aquatic radiobiologists as the inbred rodent lines have been to mammalian studies. In many other respects the Amazon molly is a satisfactory laboratory animal. It is robust, easy to rear, and has large broods of young when fully grown. Maintenance costs are low. Details are given of the conditions under which colonies reproduce.

7508 (LF—56, pp 37-40) **Method for removing trace contaminants from multicurie amounts of ^{144}Ce.** Wagner, J.A.; Kanapilly, G.M. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Removal of contaminants from stock solutions of ^{144}Ce(III) was required for large quantities of ^{144}Ce prior to incorporation into fused aluminosilicate particles for inhalation toxicology studies. Since available procedures for purification of ^{144}Ce could not be readily adapted to our laboratory conditions and requirements, a simple procedure was developed to purify ^{144}Ce in multicurie quantities of ^{144}Ce(III). This procedure consists of separation of ^{144}Ce from contaminants by precipitation and filtrations at different pH. Its simplicity and efficacy in providing a stock solution that would readily exchange into montmorillonite clay was demonstrated when it was used during the preparation of large amounts of ^{144}Ce in fused aluminosilicate particles.

7509 **Fractionated x-radiation damage to developing ovaries in the Bonnet Monkey (Macaca radiata).** Andersen, A.C. (Univ. of California, Davis); Hendrickx, A.G.; Momeni, M.H. *Radiat. Res.;* **71**: No. 2, 398-405(Aug 1977).

Fractionated x-ray exposures of 11.5 rad each (total 200 rad) given twice weekly between 77 and 133 days postcoitum severely damaged the ovaries of eight out of nine fetal bonnet monkeys. This radiation regimen reduced follicle counts by 75% or more.

RADIONUCLIDE EFFECTS - INTERNAL SOURCE

MAN

REFER ALSO TO CITATION(S) 7493

7510 (LF—56, pp 3-6) **Field characterization of plutonium aerosols in mixed-oxide fuel fabrication.** Newton, G.J.; Teague, S.V.; Yeh, H.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Nuclear reactor fuel pellets of PuO_2 and UO_2 are fabricated within safety enclosures at Babcock and Wilcox's Parker Township Site near Apolla, Pa. Nineteen sample runs were taken from within glove boxes of aerosols formed during powder comminution and blending. Eight sampling runs were also taken of a centerless grinding operation during routine industrial operations. A small seven-stage cascade impactor and the Lovelace Aerosol Particle Separator (LAPS) were used to determine aerodynamic size distribution and gross alpha aerosol concentrations. The potential toxicity of inhaled plutonium originating in the nuclear fuel cycle following accidental releases of these aerosols and possible inhalation by industrial workers is considered.

7511 (LF—56, pp 11-14) **Charge distribution on plutonium-containing aerosols produced in mixed-oxide reactor fuel fabrication and the laboratory.** Yeh, H.C.; Newton, G.J.; Teague, S.V. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

The inhalation toxicity of potentially toxic aerosols may be affected by the electrostatic charge on the particles. Charge may influence the deposition site during inhalation and therefore its subsequent clearance and dose patterns. The electrostatic charge distributions on plutonium-containing aerosols were measured with a miniature, parallel plate, aerosol electrical mobility spectrometer. Two aerosols were studied: a laboratory-produced $^{238}PuO_2$ aerosol (15.8 Ci/g) and a plutonium mixed-oxide aerosol (PU-MOX, natural UO_2 plus PuO_2, 0.02 Ci/g) formed during industrial centerless grinding of mixed-oxide reactor fuel pellets. Plutonium-238 dioxide particles produced in the laboratory exhibited a small net positive charge within a few minutes after passing through a ^{85}Kr discharger due to alpha particle emission removal of valence electrons. PU-MOX aerosols produced during centerless grinding showed a charge distribution essentially in Boltzmann equilibrium. The gross alpha aerosol concentrations (960-1200 nCi/l) within the glove box were sufficient to provide high ion concentrations capable of discharging the charge induced by mechanical and/or nuclear decay processes.

7512 (LF—56, pp 15-20) **Solubility of plutonium dioxide aerosols, in vitro.** Newton, G.J.; Kanapilly, G.M. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Solubility of plutonium aerosols is an important parameter in establishing risk estimates for industrial workers who might accidentally inhale these materials and in evaluating environmental health impacts associated with Pu. In vitro solubility of industrial plutoni-

um aerosols in a simulated lung fluid is compared to similar studies with ultrafine aerosols from laser ignition of delta phase plutonium metal and laboratory-produced spherical particles of $^{238}PuO_2$ and $^{239}PuO_2$. Although relatively insoluble, industrial plutonium-mixed oxide aerosols were much more soluble than laboratory-produced plutonium dioxide particles. Chain agglomerate aerosols from laser ignition of metallic Pu indicated in vitro dissolution half-times of 10 and 50 days for activity median aerodynamic diameter (AMAD) of 0.7 and 2.3 μm, respectively. Plutonium-containing mixed oxide aerosols indicated dissolution half-times of 40 to 500 days for particles formed by industrial powder comminution and blending. Centerless grinding of fuel pellets yielded plutonium-containing aerosols with dissolution half-times of 1200 to 8000 days. All mixed oxide particles were in the size range 1.0 μm to 2.5 μm AMAD.

7513 (NUREG—0332(Draft)) **Health effects attributable to coal and nuclear fuel cycle alternatives.** Gotchy, R.L. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Reactor Regulation). Sep 1977. 31p. Regulatory Commission, Washington, DC.

Estimates of mortality and morbidity are presented based on present-day knowledge of health effects resulting from current component designs and operations of the fuel cycles, and anticipated emission rates and occupational exposure for the various fuel cycle facilities expected to go into operation in approximately the 1975-1985 period. It was concluded that, although there are large uncertainties in the estimates of potential health effects, the coal fuel cycle alternative has a greater health impact on man than the uranium fuel cycle. However, the increased risk of health effects for either fuel cycle represents a very small incremental risk to the average individual in the public.

ANIMALS

REFER ALSO TO CITATION(S) 7432

7514 (LF—56) **Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.** Boecker, B.B.; Jones, R.K.; Barnett, N.J. (eds.). (Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. (USA). Inhalation Toxicology Research Inst.). Dec 1976. Contract EY-76-C-04-1013. 498p. Dep. NTIS, PC A22/MF A01.

Separate abstracts were prepared for 92 sections of this report.

7515 (LF—56, pp 28-32) **Monodisperse aerosols of ^{244}Cm oxides: preparation and evaluation of dissolution properties.** Kanapilly, G.M.; LaBauve, R.J. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

To study the effect of particle size and chemical form on the dissolution properties of Cm oxides, studies of monodisperse particles of Cm oxides were desirable. Therefore, methods were developed for the preparation of monodisperse ^{244}Cm oxides with geometric standard deviations less than 1.10 and a density of 6.4 g/cm^3. The dissolution behavior of monodisperse ^{244}Cm oxide particles was studied in vitro as well as in vivo after intramuscular injection in Syrian hamsters. Rate constants for dissolution of Cm oxides were calculated for both the in vitro and in vivo data.

7516 (LF—56, pp 79-83) **Radiation dose patterns from ^{106}Ru aerosols inhaled by Syrian hamsters. II. Retention and tissue distribution.** Newton, G.J.; Snipes, M.B.; Boecker, B.B.; Wagner, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

The whole-body retention and tissue distribution of inhaled ^{106}Ru were determined in Syrian hamsters. Aerosols of ^{106}Ru—Rh ruthenium oxalate were generated in nitrogen atmospheres and subjected to temperatures of 27, 300, 600, or 1100°C prior to animal inhalation exposures. Aerosols treated at 27°C and 300°C exhibited higher in vivo solubility and lower whole-body retention than aerosols treated at 600°C and 1100°C. However, the long-term retained component, though smaller, was cleared with a longer half-time than for aerosols treated at higher temperatures. No significant concentrations of ruthenium were found in kidney. The highest concentrations for inhaled ^{106}Ru compounds were found in lung, liver, bone, and possibly the nasopharyngeal region; the remaining body burden was diffusely distributed in soft tissue.

7517 (LF—56, pp 84-87) **Biliary excretion of ^{144}Ce after inhalation of ^{144}Ce citrate in rats and Syrian hamsters. III.** Lustgarten, C.S.; Boecker, B.B.; Cuddihy, R.G.; Kanapilly, G.M. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

In previous studies the clearance of soluble forms of ^{144}Ce from the liver has been found to be faster in mice, rats and rabbits than in Beagle dogs or Chinese hamsters. Measurements of biliary excretion of ^{144}Ce in the two animal species following aerosol inhalation have helped to identify the reasons for these differences. Fifty-three rats and 27 Syrian hamsters were exposed by inhalation to aerosols of ^{144}Ce citrate to achieve retained body burdens which ranged between 10-20 μCi. Bile was collected for a period of 36 to 60 hr from an average of seven rats and three hamsters at various times up to 128 days after exposure and was measured for ^{144}Ce activity. After bile collection, animals were sacrificed and their tissues were analyzed to determine ^{144}Ce content. It was found that the clearance of cerium from the livers of rats was primarily due to biliary excretion. In hamsters, the liver avidly retained ^{144}Ce with a very small fraction excreted in the bile.

7518 (LF—56, pp 88-92) **Effect of acidity on the retention and distribution of inhaled $^{144}CeCl_3$.** Kanapilly, G.M.; Sparling, L.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

The effect of acidity of aerosol droplets on the retention of inhaled $^{144}CeCl_3$ was examined. Syrian hamsters were exposed via inhalation to $^{144}CeCl_3$ aerosols generated from solutions containing 3.0 mg of Ce/ml and pH at 1.0, 2.9 or 5.0. After the early clearance, the half-times of whole-body retention for the remaining 20% of the ^{144}Ce initial body burdens were 20, 30 and 100 days, respectively, for aerosols generated at pH 1.0, 2.9 or 5.0. However, the tissue distribution data for lung, liver or bone did not indicate significant differences in the in vivo solubilities in metabolism of the three $^{144}CeCl_3$ aerosols. For each group of hamsters, about 30% of the initial lung burden of ^{144}Ce was transported from lung to liver and bone. Comparisons of in vivo dissolution of $^{144}CeCl_3$ aerosols in the lung and in vitro dissolution in three different solvents were also made.

7519 (LF—56, pp 93-95) **Radiation dose pattern following inhalation of monodisperse and polydisperse aerosols of $^{241}AmO_2$ in beagle dogs. I.** Mewhinney, J.A.; Hobbs, C.H.; Mo, T.; Muggenburg, B.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Beagle dogs were exposed via inhalation to monodisperse or polydisperse aerosols of $^{241}AmO_2$ to define the resultant radiation dose pattern and thus establish the relative risk in humans of inhalation of $^{241}AmO_2$ and $^{239}PuO_2$ or a combination thereof. Three monodisperse aerosol sizes (3.0 μm, (1.5 μm and 0.75 μm) aerodynamic diameter (AD) and one polydisperse aerosol size 1.5 μm) activity median aerodynamic diameter (AMAD) were employed to assess the role of particle size in the in vivo solubility of $^{241}AmO_2$ in lung and the translocation of solubilized material in other tissues. Animals are scheduled for sacrifice at 8, 32, 64, 128, 256, 365 and 730 days after inhalation exposure with at least three animals held for later sacrifice in each particle size group. Inhalation exposures were conducted to achieve an initial lung burden of approximately equal to 0.07 μCi/kg body weight. Periodic excretion collections are being made on all animals in the study. Preliminary data are reported on the tissue distribution of ^{241}Am measured in animals sacrificed at 64 days after inhalation exposure. Radiochemical analysis of samples obtained in this study is continuing.

7520 (LF—56, pp 96-98) **Radiation dose patterns in beagle dogs following inhalation of monodisperse and polydisperse aerosols of $^{238}PuO_2$.** Mewhinney, J.A.; Hobbs, C.H.; Muggenburg, B.A.; Mo, T. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Radiation dose patterns are being determined in Beagle dogs after inhalation of different sizes of monodisperse or a polydisperse aerosol of $^{238}PuO_2$. Aerosol sizes employed in the study were 0.7, 1.4, 2.7 μm aerodynamic diameter (AD) monodisperse aerosols and a 1.4 μm activity median aerodynamic diameter (AMAD) polydisperse aerosol. Twenty-six Beagle dogs were exposed to achieve initial lung burdens ofapproximately equal to 0.07 μCi/kg for each aerosol form and are being serially sacrificed in groups of two animals at 4 hr, 4, 8, 16, 32, 64, 128, 356, 730 days, 4, 6 and 8 yr after inhalation exposure. Since the study has been in progress only a short time, only limited data are available at this time. The primary purpose of the study is to provide information on the radiation dose distribution to organs and tissues of the Beagle dog as a function of particle size. These data will be of great value in interpreting dose-response relationships following inhalation of different sized aerosols of $^{238}PuO_2$ observed in other studies at this laboratory.

7521 (LF—56, pp 99-104) **Inhalation toxicology of industrial uranium and plutonium mixed oxides. I. Generation of aerosols from dry powders and preliminary rodent studies.** Eidson, A.F.; Mewhinney, J.A.; Hahn, F.F.; Mo, T. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Two powder samples of industrial mixed U and Pu oxides were obtained from a fuel fabrication facility. Aerosols produced at the industrial facility were analyzed in terms of particle size distribu-

tion parameters, density, and total alpha activity concentration. Methods of regeneration of aerosols from these dry powders with properties similar to those observed during onsite sampling were considered. A modified vortex tube was able to generate aerosols similar to those observed on-site. A 64-day, pilot radiation dose pattern study was completed using each material. The desired initial lung burden for each study was 100 nCi. The achieved average initial lung burdens for the 750°C treated and the 1750°C treated aerosols were 110 nCi and 970 nCi, respectively. There were no early deaths among rats exposed to the 750° treated aerosols, but seven rats exposed to the 1750°C treated aerosols died before the scheduled end of the study. This result is attributed to the overexposure of the animals to the aerosol. Lung retention of the 750°C treated aerosol indicates a retention half-time of 115 days. Analysis of liver and femur indicated that 2.5% of the sacrifice body burden of the 750°C treated material was in each of these tissues. The corresponding value for the 1750°C treated material is 0.3%. These results indicate the greater relative in vivo solubility of the 750°C treated material. Histological examinations were made on tissues obtained at necropsy from all animals that died during the experiment. Lesions were found only in the lungs and the results indicate that early deaths were due to radiation pneumonitis.

7522 (LF—56, pp 114-117) **Spatial and temporal distribution of PuO_2 aerosol particles deposited in the lung of a rodent via inhalation. II.** Diel, J.H.; Felicetti, S.A.; Mewhinney, J.A.; Snipes, M.B. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

In the computation of dose to tissue due to insoluble PuO_2 particles deposited in deep lung, the extremely short range of the emitted alpha particles makes it imperative to know the distribution of the particles as a function of time after inhalation. In addition, the effectiveness of lung lavage as a means of removal of insoluble PuO_2 particles from the lung may depend on the distribution of the particles remaining as well as on the fraction remaining. In order to study this distribution of particles in lung, a series of experiments have been initiated in which Syrian hamsters and Fischer-344 rats were exposed via inhalation to a monodisperse aerosol of $^{238}PuO_2$ particles of 0.8 μm AD. Of the animals exposed, some of the Syrian hamsters were lavaged according to various schedules. Animals have been included in a serial sacrifice study to obtain retention and localization information. Radiochemical analysis has been used to measure overall retention and measurements of local distribution have been made using autoradiographs of lung tissue sections and semiautomated computer data processing techiques. Data on local dose are not available on lavaged animals at present, but preliminary data on unlavaged Syrian hamsters indicate that agglomeration of particles has occurred by 136 days after exposure. The degree and type of agglomeration observed are compatible with a hypothesis of clustering by differential clearance as opposed to active accumulation of particles in preferred regions.

7523 (LF—56, pp 118-122) **Local dose to the deep lung of a Syrian hamster from a single $^{238}PuO_2$ particle.** Diel, J.H. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A considerable variation in the effects of alpha-emitting radionuclides in lung may occur depending upon whether the material is uniformly distributed throughout the lung or is contained in hot spots. To understand the influence of distribution biological effects and to aid the extrapolation of results of animal experiments utilizing insoluble alpha emitters to other species including man, quantitative descriptions must be obtained for the patterns of radiation dose associated with these hot spots. This report addresses the case of a single $^{238}PuO_2$ particle deposited in the deep lung of a Syrian hamster. Dose rate as a function of position around such a particle is computed using actual tissue configurations obtained from autoradiographs of lung sections containing $^{238}PuO_2$ particles. The number of cells surviving, S, and the expected effect, E, as a function of the number of disintegrations is computed using the empirical equations S = exp(-0.01D) and E = D/sup x/ exp(-0.01D); x = 0.5, 1, 2, respectively where D is the dose. These results have been compared to similar calculations based on 0.2 g/cm^3 homogeneous tissue and on uniform dose approximations. The homogeneous tissue model gave average dose and effect results similar to those obtained from the actual tissue configurations while the results obtained from assuming uniform dose over the irradiated region differed considerably.

7524 (LF—56, pp 137-142) **Respiratory tract retention of inhaled particles in experimental animals.** Cuddihy, R.G. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A variety of inhalation studies have been reviewed to develop a model for describing the retention of particles in the respiratory tracts of several species of experimental animals. Presently, the respiratory tract clearance model receives the greatest use in the radiation protection field. This model has several disadvantages in its basic construction and in its application to radionuclide exposures of people to heterogeneous aerosolized substances. These are discussed and an alternative model is described. The alternative model uses time-varying solubility functions to described absorption of material from the lung and upper respiratory tract. The solubility functions can be determined from studies in experimental animals or can be approximated from in vitro chemical systems. Application of this model to data from several experimental studies is included.

7525 (LF—56, pp 149-153) **Toxicity of inhaled beta-emitting radionuclides: an experimental approach.** Hahn, F.F.; McClellan, R.O.; Benjamin, S.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

An experimental approach to evaluation of the toxicity of inhaled beta-emitting radionuclides in experimental animals is described. These radionuclides are being studied in both relatively soluble ($^{90}SrCl_2$, $^{144}CeCl_3$, $^{91}YCl_3$, $^{137}CsCl$) and relatively insoluble aerosol forms (^{90}Y, ^{91}Y, ^{144}Ce and ^{90}Sr in fused aluminosilicate particles). Initial lung or whole-body activity burdens were selected to result in early deaths due to severe lesions at the highest exposure levels, and more subtle changes, such as neoplasia, at the lower levels. The organs affected vary depending on the solubility and chemical characteristics of the isotope. These studies with young adult dogs are complemented with comparable studies in other species (mice, Syrian hamsters) and with animals of different ages (immature, aged). This basic approach, with emphasis on factors that alter the resulting radiation dose pattern, offers the maximum likelihood of meeting the continuing, and not always predictable, needs for information on the toxicity of inhaled beta-emitting radionuclides that may be encountered in nuclear industry operations.

7526 (LF—56, pp 154-157) **Toxicity of inhaled $^{90}SrCl_2$ in beagle dogs. X.** Benjamin, S.A.; Muggenburg, B.A.; Boecker, B.B.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Studies on the metabolism, dosimetry, and effects of inhaled $^{90}SrCl_2$ in the Beagle dog are continuing in an effort to provide a basis for assessing the consequences of inhaling ^{90}Sr such as might be released in certain nuclear accidents. Seventy-two dogs were exposed to aerosols containing ^{90}Sr resulting in initial body burdens ranging from 2.5 to 250 μCi ^{90}Sr/kg body weight. Forty-eight of these dogs are being maintained for lifetime observation. The skeletons of the dogs dying with bone-related neoplasms received initial radiation dose rates of 3.2 to 55 rads/day and cumulative doses to death of 2800 to 22,000 rads. Nine control dogs have died or been euthanized, one during the last year with a mammary adenocarcinoma. Serial observations are continuing on the 18 surviving ^{90}Sr dogs and 13 controls.

7527 (LF—56, pp 158-163) **Toxicity of inhaled $^{144}CeCl_3$ in beagle dogs. X.** Benjamin, S.A.; Boecker, B.B.; Lustgarten, C.S.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Studies on the metabolism, dosimetry, and effects of inhaled $^{144}CeCl_3$ in Beagle dogs are continuing to aid in assessing the biological consequences of inhaling ^{144}Ce such as might be released in certain nuclear accidents. Studies on the organ distribution of inhaled $^{144}CeCl_3$ have shown that the ^{144}Ce deposited in lung is translocated at a moderately rapid rate to liver and skeleton and that significant radiation doses are accumulated by all three organs. Fifty-five dogs that inhaled $^{144}CeCl_3$ and 15 control dogs are being observed for their life span. The ^{144}Ce dogs have long-term retained burdens with values ranging from 20 to 2900 μCi. Pathological changes observed at autopsy are reported.

7528 (LF—56, pp 164-166) **Toxicity of inhaled $^{91}YCl_3$ in beagle dogs. X.** Muggenburg, B.A.; Benjamin, S.A.; Boecker, B.B.; McClellan, R.O. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Studies on the metabolism, dosimetry, and effects of inhaled $^{91}YCl_3$ in Beagle dogs are being continued to provide information that will aid in assessing the biological consequences of nuclear accidents in which ^{91}Y or other radionuclides that produce a similar radiation dose pattern may be released. Forty-two dogs with ^{91}Y initial body burdens from 64 to 1300 μCi/kg body weight were placed in four groups with mean lung burdens of 310, 180, 75 and 40 μCi/kg body weight. These dogs and 12 control dogs are being maintained for lifetime observation. An additional group of four dogs with a mean initial ^{91}Y body burden of 180 μCi/kg body weight were placed in a sacrifice study. Eleven dogs within the highest activity level groups died or were euthanized at 12 to 33 days after inhalation of ^{91}Y with changes related to severe bone marrow damage and associated pancytopenia. Two dogs died approximately 1 yr after ^{91}Y inhalation with convulsive seizures that were presumed to be unrelated to the ^{91}Y exposure. Five ^{91}Y-

exposed dogs died or were euthanized due to neoplasms 2000 to 3341 days after exposure. Three dogs had nasal squamous cell carcinomas, one had a bronchioloalveolar carcinoma and another, a mast cell sarcoma. One dog died of renal failure 2660 days after exposure and one control dog died of empyema. Serial observations are continuing on all surviving dogs.

7529 (LF—56, pp 167-171) **Toxicity of injected ^{137}CsCl in beagle dogs. IX.** Lustgarten, C.S.; Benjamin, S.A.; Hobbs, C.H.; Boecker, B.B.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A.; Redman, H.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Studies on the metabolism, dosimetry and effects of intravenously administered ^{137}CsCl in the Beagle dog are being conducted to aid in assessing the biologic consequences of exposure to ^{137}Cs such as occurs in the event of certain nuclear accidents. Effects of the chronic, relatively uniform whole-body exposure produced by ^{137}Cs are being compared with other diverse radiation dose patterns resulting from inhalation of radioactive aerosols. Sixty-six dogs were entered into the study: six with a mean initial ^{137}Cs body burden of 3780 μCi/kg and five groups of 12 dogs each with mean initial ^{137}Cs body burdens of 2820, 1940, 1420, 970 and 0 μCi/kg. Seventeen of the dogs injected with ^{137}CsCl have died: 11 at 19 to 81 days after injection and cumulative whole-body doses of 860 to 1400 rads died with severe bone marrow damage and resultant pancytopenia; two at 2471 and 2707 days after injection and cumulative doses of 690 and 1800 rads with a neurofibrosarcoma of the liver and a mast cell tumor of the skin; four at 693 to 2148 days after injection and cumulative doses of 840 to 2000 rads with shock, aspiration pneumonia, severe arthritis and renal amyloidosis. Two control dogs died; one at 647 days with auto-immune hemolytic anemia and one at 2442 days with renal amyloidosis. Serial observations are continuing on the 37 ^{137}CsCl dogs and 10 control dogs. The ^{137}CsCl dogs now alive have cumulative whole-body doses of 550 to 2200 rads at 2777 to 3031 days after injection.

7530 (LF—56, pp 172-175) **Toxicity of inhaled ^{90}Y in fused aluminosilicate particles in beagle dogs. VIII.** Lay, J.C.; Hobbs, C.H.; Hahn, F.F.; Jones, R.K.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Studies on the metabolism, dosimetry, and biological effects of inhaled ^{90}Y in fused aluminosilicate particles in the Beagle dog are in progress to assess the consequences of inhalation of an energetic beta emitter that has a short effective half-life in th lung. A radiation dose pattern study in which 12 dogs were sacrificed in pairs at 0, 2, 4, 6, 8 and 12 days after exposure has been completed. A longevity study in which 89 dogs were exposed to initial lung burdens ranging from 80 to 5200 μCi/kg body weight and 12 control dogs were exposed to stable yttrium in fused aluminosilicate particles is in progress. The short half-life and the relative insolubility of the ^{90}Y in this vector at the doses achieved resulted in a radiation insult to the lung and surrounding structures at a relatively high, but rapidly decreasing dose rate. To date, 39 dogs with cumulative doses to lung from 7200 to 70,000 rads have died from 7.5 to 2250 days after exposure. The predominant findings in these dogs has been radiation pneumonitis, pulmonary fibrosis and right heart dilation and hypertrophy. One dog which died 903 days after exposure with a dose to lung of 11,000 rads also had two small pulmonary adenomas. Only one dog has died during the past year. This dog (333S) died 2250 days after exposure with a dose to lung of 7200 rads and had severe pulmonary edema, extensive pulmonary fibrosis, right heart dilation and hypertrophy and a small bronchioloalveolar carcinoma of the lung. Several dogs in the higher dose levels still containingsuggestive of right heart enlargement and/or pulmonary fibrosis. Two exposed dogs are on replacement therapy with a synthetic thyroid hormone for treatment of hypothyroidism. Fifty exposed dogs and 12 control dogs remain alive at 2009 to 2565 days after exposure and will continue to be studied for the remainder of their life span.

7531 (LF—56, pp 176-179) **Toxicity of inhaled ^{91}Y in fused aluminosilicate particles in beagle dogs. VII.** Lay, J.C.; Cuddihy, R.G.; Hahn, F.F.; Hobbs, C.H.; Jones, R.K.; Kanapilly, G.M.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Studies of the radiation hazards due to inhalation of ^{91}Y in fused aluminosilicate particles have been undertaken in Beagle dogs to aid in assessing the biological consequences of inhaling a relatively insoluble, energetic beta emitter with an intermediate effective half-life in the lung. A radiation dose pattern study in which 30 dogs were serially sacrificed from 0 to 320 days after inhalation exposure to ^{91}Y in fused aluminosilicate particles has been completed and results are reported. A longevity study is in progress in which 96 dogs were exposed to achieve initial lung burdens ranging from 11 to 300 μCi ^{91}Y in fused aluminosilicate particles/kg body weight and 12 dogs were exposed to stable yttrium in fused aluminosilicate particles. To date, 47 dogs have died in the longevity study between 113 and 1847 days after exposure. Forty-nine exposed dogs with doses to lung of 2,400 to 23,000 rads and 12 control dogs remain alive from 1833 to 2381 days after inhalation exposure and will continue to be studied throughout the remainder of their life span with attention directed toward determining the relationship between radiation dose, dose rate and biologic effects.

7532 (LF—56, pp 180-185) **Toxicity of inhaled ^{144}Ce in fused aluminosilicate particles in beagle dogs. IX.** Hahn, F.F.; Boecker, B.B.; Hobbs, C.H.; Jones, R.K.; Lay, J.C.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

The metabolism, dosimetry and effects of ^{144}Ce inhaled in fused aluminosilicate particles are being investigated in the Beagle dog to assess the biological consequences of release of ^{144}Ce in a relatively insoluble form such as might occur in certain types of nuclear accidents. The toxicity of inhaled ^{144}Ce is also of general interest since it is representative of intermediate-lived beta-emitting radionuclides. Two major studies with young adult dogs (12 to 14 mo of age at exposure) are involved: a metabolism and dosimetry study in which 24 dogs were serially sacrificed over an extended period of time; and a longevity study with two series of dogs. Series I contains 15 dogs exposed to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 11 to 210 μCi/kg body weight and three control dogs exposed to nonradioactive fused aluminosilicate particles. Series II contains 96 dogs exposed to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 0.0024 to 66 μCi/kg body weight and 12 control dogs exposed to nonradioactive fused aluminosilicate particles. To date, 44 dogs have died or were euthanized at 143 to 2682 days after inhalation of ^{144}Ce. The prominent findings were radiation pneumonitis in dogs that died or were euthanized at early time periods and neoplastic disease in dogs that died or were euthanized at 750 days or later.

7533 (LF—56, pp 186-189) **Toxicity of inhaled ^{144}Ce in fused aluminosilicate particles in immature beagle dogs. V.** Boecker, B.B.; McClellan, R.O.; Hahn, F.F.; Hobbs, C.H.; Lay, J.C.; Mauderly, J.L. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Immature Beagle dogs (approximately 3 months of age at exposure) have been exposed by inhalation to an aerosol of ^{144}Ce in fused aluminosilicate particles to compare the resulting patterns of metabolism, dosimetry and biological effects with those seen in dogs exposed at 12 to 14 mo of age and 8 to 10.5 yr of age. These studies will assess possible age-related differences in the biological behavior and effects of inhaled radionuclides: differences that may be of significance in predicting the response of accidentally-exposed human populations that include individuals of different ages.

7534 (LF—56, pp 190-194) **Toxicity of inhaled ^{144}Ce in fused aluminosilicate particles in aged beagle dogs. V.** Hahn, F.F.; Boecker, B.B.; Hobbs, C.H.; Lay, J.C.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

The toxicity of ^{144}Ce in fused aluminosilicate particles inhaled by 8- to 10.5-yr-old dogs is being investigated to provide information on age-related differences in the response of older members of the human population to accidental inhalation of radioactive aerosols. These data on aged dogs will be compared to the results of similar studies of dogs exposed at approximately 3 mo or 12 to 14 mo of age. Six blocks of five female dogs each have been divided into four exposure levels with mean initial lung burdens of 7.2, 14, 28 and 57 μCi ^{144}Ce/kg body weight. Six blocks of four male dogs have been divided into three exposure levels with mean initial lung burdens of 7.2, 14 and 28 μCi ^{144}Ce/kg body weight. Controls in each block were exposed to fused aluminosilicate particles containing stable cerium. Fifteen dogs with initial lung burdens ranging from 20 to 75 μCi ^{144}Ce/kg body weight and cumulative doses to lung of from 22,000 to 74,000 rads have died or were euthanized 197 to 1207 days after exposure with clinicopathologic findings of radiation pneumonitis and pulmonary fibrosis.Pulmonary retention of the inhaled ^{144}Ce was similar to that observed previously in dogs exposed at 18 to 22 mo of age in a radiation dose pattern study. Serial observations are continuing on the 19 surviving ^{144}Ce-exposed and eight control dogs.

7535 (LF– 56, pp 195-199) **Toxicity of inhaled ^{90}Sr in fused aluminosilicate particles in beagle dogs. VII.** Snipes, M.B.; Boecker, B.B.; Hahn, F.F.; Hobbs, C.H.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Studies on the metabolism, dosimetry, and biological effects of ^{90}Sr inhaled in a relatively insoluble form by Beagle dogs have continued during the past year to define the biological consequences of inhaling this important radionuclide in a form which has a long retention time in the lung. One hundred and six dogs were exposed to a polydisperse aerosol (AMAD 1.4 to 2.8 μm and sigma/sub g/ 1.4 to 2.7) of fused aluminosilicate particles labeled with ^{90}Sr. Initial lung burdens ranged from 0.21 to 94 μCi ^{90}Sr per kilogram of body weight (μCi/kg). Eighteen control dogs were exposed to an aerosol of stable strontium in fused aluminosilicate particles. These 124 dogs were assigned to the longevity study. An additional 26 dogs were exposed similarly to achieve lung burdens of approximately 1.5 to 12 μCi/kg (AMAD 1.9 to 2.5 μm and sigma/sub g/ 1.6 to 2.0) and assigned for sacrifice at intervals after exposure to define metabolism and dosimetry of this aerosol in Beagle dogs. Of the longevity dogs, 32 dogs having initial lung burdens of 29 to 94 μCi ^{90}Sr/kg and cumulative doses to lung to death of 40,000 to 96,000 rads have died from radiation pneumonitis and/or pulmonary fibrosis from 159 to 477 days after exposure. Twenty dogs with initial lung burdens of 4.3 to 36 μCi ^{90}Sr/kg and cumulative doses to lung to death of 25,000 to 68,000 rads have died from hemangiosarcomas in the lung or heart between 644 and 2156 days after exposure. In addition, one dog developed a bronchioloalveolar carcinoma, another developed epidermoid carcinoma of the lung and a third dog developed a squamous cell carcinoma in the nasal cavity. The remaining exposed dogs and controls of the longevity study are surviving at 657 to 2438 days after exposure.

7536 (LF—56, pp 200-204) **Nasal carcinomas in beagle dogs after inhalatioon of relatively soluble forms of beta-emitting radionuclides.** Benjamin, S.A.; Boecker, B.B.; Snipes, M.B.; Cuddihy, R.B.; McClellan, R.O. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Beagle dogs were exposed by inhalation to relatively soluble forms of three beta-emitting radionuclides and are being held for life span observation to evaluate hazards associated with nuclear power production. Dogs were exposed to graded activity levels of $^{91}YCl_3$, $^{144}CeCl_3$ or $^{90}SrCl_2$. With $^{91}YCl_3$ and $^{144}CeCl_3$, significant radiation dose was delivered to liver, respiratory tract, and skeleton. With $^{90}SrCl_2$, the dose was essentially to skeleton. Nasal cavity squamous cell carcinomas have been the most frequent neoplasms in the ^{91}Y and one of the most frequent in the ^{144}Ce study while relatively few have been seen after ^{90}Sr exposure. Also one nasal cavity hemangiosarcoma was seen in the ^{144}Ce study. The ^{90}Sr-exposed dogs have survived longer after exposure and have higher skeletal radiation doses than do the dogs exposed to ^{91}Y or ^{144}Ce. The greater incidence of nasal carcinomas can be explained by the finding of high concentrations of the lanthanides, ^{91}Y and ^{144}Ce, associated with the nasal turbinate epithelium.

7537 (LF—56, pp 205-207) **Hepatic degeneration in beagle dogs after chronic hepatic beta-irradiation.** Benjamin, S.A.; Lustgarten, C.S.; Pickrell, J.A.; Wolff, R.K. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Dogs exposed to the beta-emitting radionuclides $^{144}CeCl_3$ and $^{91}YCl_3$ by inhalation have received significant radiation doses to liver. Those that have died at later times after exposure (more than 1500 days) have shown a high incidence of severe hepatic degeneration and nodular hyperplasia. This is in contrast with age-matched controls and dogs exposed to radionuclides such as $^{90}SrCl_2$ where the dogs receive no radiation dose to liver. The latter dogs have shown relatively little evidence of liver damage. More than half of the surviving dogs exposed to $^{144}CeCl_3$ show evidence of liver disease on liver function tests. Nuclear medicine scanning techniques have been shown to be effective in evaluating liver disease in vivo. These procedures will be used to derive a better understanding of the dose-response relationships involved.

7538 (LF—56, pp 208-212) **Morphologic characteristics of lung tumors in beagle dogs after inhalation of ^{91}Y in fused aluminosilicate particles.** Hahn, F.F.; Lay, J.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

The lung tumors from six dogs dying after inhalation of ^{91}Y in fused aluminosilicate particles have been examined with light and electron microscopy. The tumors were all epithelial in nature and originated in the peripheral lung. The histologic types were classified as bronchioloalveolar carcinoma, combined squamous cell-bronchioloalveolar carcinoma and bronchogenic adenocarcinoma. Electron microscopy revealed that several cell types were involved in three of the carcinomas. These lung tumors differ in histologic type from those in man associated with inhalation of radon and radon daughters.

7539 (LF—56, pp 213-216) **Effects of current inhalation exposure methods on cardiopulmonary function of immature dogs.** Mauderly, J.A.; Muggenburg, B.A.; Lay, J.C. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Approximately 9% of 84 3-mo-old dogs exposed to inhalation of radioactive aerosols have experienced respiratory failure during exposure. A study was conducted to evaluate effects of exposure on cardiopulmonary function of immature dogs. Results indicate that the combination of nose breathing and breathing into the aerosol delivery cone quadrupled breathing effort of 3-mo-old dogs. Excitement exacerbated a failure to maintain adequate alveolar ventilation and resulted in CO_2 retention and acidosis. General anesthesia and use of an endotracheal tube alleviated problems due to nasal airflow resistance and behaviorally-related increases in ventilatory requirement.

7540 (LF—56, pp 217-220) **Toxicity of inhaled ^{144}Ce fused aluminosilicate particles in BALB/C mice.** Hahn, F.F. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Three hundred and twelve BALB/C mice have been exposed by inhalation to aerosols of ^{144}Ce fused aluminosilicate particles to achieve lung burdens of 0.03 μCi to 1.6 μCi ^{144}Ce and will be observed for their life span. One hundred and twenty mice have been exposed to ^{144}Ce in fused aluminosilicate particles to achieve lung burdens of 0.36 +- 0.14 μCi ^{144}Ce and will be sacrificed at intervals to determine the pulmonary retention of ^{144}Ce and to document nonlethal disease in the mice. The survival and lung tumor incidence in these mice will be compared to similar data from BALB/C mice with whole body and thoracic gamma irradiation and C57BL/6J mice exposed to aerosols of $^{144}CeO_2$.

7541 (LF—56, pp 223-228) **Toxicity of inhaled alpha-emitting radionuclides: an experimental approach.** Hobbs, C.H.; McClellan, R.O.; Boecker, B.B.; Halliwell, W.H.; Lustgarten, C.S.; Merickel, B.S.; Mewhinney, J.A.; Miglio, J.J.; Mo, T.; Stalnaker, N.D. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A series of interrelated dose-response studies in which Beagle dogs and rodents are being exposed to aerosols of transuranic alpha-emitting radionuclides is described. The characteristics of monodisperse aerosols of oxides of ^{239}Pu, ^{238}Pu, ^{241}Am, ^{244}Cm, and ^{242}Cm are discussed for use in studies to determine the relative importance on the resulting biological effects of such factors as the local dose around particles, specific activity of particles, particle size, and number inhaled (the hot particle question). Other factors such as the elemental characteristics and the chemical form of the material and the age of the animal at the time of inhalation which may influence the toxicity of these radionuclides are also being studied. The purpose of the studies is to determine the basic relationships between the radiation dose pattern and resulting biological effects.

NUCLIDE KINETICS AND TOXICOLOGY

REFER ALSO TO CITATION(S) 7385

MAN

REFER ALSO TO CITATION(S) 7415, 7434, 7493

ANIMALS

REFER ALSO TO CITATION(S) 7434, 7514

PLANTS

REFER ALSO TO CITATION(S) 7434

7542 **Multivariate analysis of factors affecting radiocesium uptake by Sagittaria latifolia in coastal plain environments.** Garten, C.T. Jr.; Paine, D. . (Univ. of Georgia, Athens). *J. Environ. Qual.;* **6**: No. 1, 78-82(1977).

Sagittaria latifolia plants and soils were sampled at 11 sites on or near the Energy Research and Development Administration's Savannah River Plant near Aiken, South Carolina. Plants and soils were analyzed for radiocesium concentrations. Concentration ratios (CR) were calculated as a relative measure of availability. On the basis of eight sites, which were similar in soil properties, three principal components, extracted from a correlation matrix, explained 80.8% of the total variation in measurements of soil characteristics. Principal component I was directly associated with soil moisture, soil organic matter, extractable potassium, percent very fine sand, and inversely related to percent coarse soil. Component II was related to coarse soil and fine sandy soil. Component III was related to extractable soil potassium and extractable radiocesium. A multiple regression of log (CR) against the principal component scores demonstrated a decrease in the availability of radiocesium to Sagittaria

with increasing soil moisture, organic matter, extractable potassium, and percent very fine sand and silt. Availability was greatest on coarse sandy soils. Maximum likelihood factor analysis across all eleven sites, based on a partial correlation matrix adjusted for differences among locations, indicated that, regardless of soil radiocesium concentrations, the availability of radiocesium was directly related to soil particle size (% weight) >0.05 mm and inversely related to particle size (% weight) <0.25 mm.

THERMAL EFFECTS

REFER ALSO TO CITATION(S) 7053

MICROORGANISMS

7543 Inactivation of poliovirus in wastewater sludge with radiation and thermoradiation. Ward, R.L. (Sandia Labs., Albuquerque, NM). *Appl. Environ. Microbiol.;* **33**: No. 5, 1218-1219(May 1977).

The effect of sludge on the rate of viral inactivation by radiation and thermoradiation was determined. The virus used for the experiments was the poliovirus type 1 strain CHAT, which was grown in HeLa cells. Radiation, heat, and thermoradiation treatments were carried out in a chamber specifically designed to permit rapid heating and cooling of the samples at the beginning and completion of treatment, respectively. The treated samples were then assayed for plaque-forming units on HeLa cells after sonication in 0.1% sodium dodecylsulfate (SDS). For the radiation treatment virus was diluted 10-fold into PBS containing new sludge, irradiated at 20°C with ^{137}Cs at a dose rate of 30 krads/min, and assayed for infectious virus. The results show that raw sludge is protective of poliovirus against ionizing radiation but that small concentrations of sludge are nearly as protective as large concentrations. When heat and radiation are given simultaneously, however, the amount of protection afforded by sludge is less than the additive effects of the individual treatments. This result is especially evident at low concentrations of sludge. It appears, therefore, that thermoradiation treatment may be an effective way of inactivation viruses in waters containing low concentrations of suspended solids. (FMM)

7544 Unique thermal aquatic environment: a microbial characterization. Greenwood, J.R.; Steenbergen, J.F. (San Diego State Univ., CA). *Hydrobiologia ;* **51**: No. 3, 265-273(15 Dec 1976).

Thermal aquatic environments provide a unique situation for the study of the ecology of microorganisms. As the heated water flows away from the spring it cools to form a thermal gradient. Essentially the only variable along this gradient is temperature. A thermal artesian well located in the southeastern corner of Riverside County, California was used in the study. Blue-green algae, diatoms and heterotrophic bacteria present at various temperatures along the thermal gradient were identified and their presence was correlated with the micronutrients and trace minerals (lead, iron, copper, zinc, magnesium, manganese and mercury) found in the water of the outflow.

7545 Effect of heated waters on biocenosis of the moderately polluted Narew River. General conclusions. Kajak, Z. (Polish Academy of Sciences, Lomianki, Poland). *Pol. Arch. Hydrobiol.;* **23**: No. 4, 555-561(1976).

The cumulative effect of heating (by 2°C) and pollution in a lowland river results in a growth of biomass and share of blue-green algae in the phytoplankton at a drop of diatoms, growth in Actinomycetes and Coli index, decline in the number of benthic Chironomidae species, greater fluctuation in Tubificidae number, and increased destructive processes. Heating itself, possible to observe only on stationary communities, caused a drop in the number of benthic Chironomidae species, an increase in the share of sexually mature Tubificidae and increased fluctuation in their number in time, a slight growth in number of mesosaprobic species in the periphyton.

PLANTS

REFER ALSO TO CITATION(S) 7545

7546 Effect of heated waters on biocenosis of the moderately polluted Narew River. Periphyton. Andrzejczak-Czechowska, I.; Wisniewski, R.J. (Polish Academy of Sciences, Lomianki, Poland). *Pol. Arch. Hydrobiol.;* **23**: No. 4, 519-526(1976).

The effect of heated waters discharged from the power station on the periphyton algae communities was studied in the slightly polluted lowland Narew River. The discharge of heated water caused a rise of temperature of the river waters by about 2°C in summer, after mixing up of the discharge waters with the river waters. In the most strongly heated sector of the river a decrease in the density of periphyton algae and in the number of diatoms species was observed as well as an increase in the ratio of the indicator-forms of alpha-mesosaprobity, especially in warm seasons of the year. The decrease in the number of diatoms species and the increase in the ratio of the forms indicating alpha-mesosaprobity were also observed in the summer and autumn in the most strongly polluted sector of the river, downstream below the discharge of the wastes from the sewage treatment plant at Ostroleka.

7547 Effect of heated waters on biocenosis of the moderately polluted Narew River. Phytoplankton. Turczynska, J.; Wisniewski, R.J. (Polish Academy of Sciences, Lomianki, Poland). *Pol. Arch. Hydrobiol.;* **23**: No. 4, 507-518(1976).

The effects of a power station on phytoplankton were investigated in the moderately polluted lowland the Narew River. On the main the rise of water temperature did not cause any changes in the species composition, composition of dominants, density and biomass of phytoplankton and pheopigments/chlorophyll a ratio. Only in the case of the intake of more than 30 percent of the river rate of flow for cooling purposes an increase in the ratio of blue-green algae in the total number and biomass of the phytoplynkton was observed in the waters directly below the discharge of the cooling waters. An increase in the number and biomass of blue-green algae was also observed in the sector of the river remaining under the combined of heating and pollution, especially at the time of the low water flow rate in the river in summer and autumn 1973, an increase in the number and biomass of green algae was also observed as well as a strong development of nannoplanktonic forms in summer 1973.

INVERTEBRATES

REFER ALSO TO CITATION(S) 7545, 7550, 7575

7548 Effect of heated waters on biocenosis of the moderately polluted Narew River. Oligochaeta. Wisniewski, R.J. (Polish Academy of Sciences, Lomianki, Poland). *Pol. Arch. Hydrobiol.;* **23**: No. 4, 527-538(1976).

The effects of a power station effluent on the benthic oligochaetes communities were studied in the slightly polluted lowland Narew River. In result of a slight rise of water temperature in the stream of the river below the power station, not exceeding 2°C in the summer time, the periods of an intensive sexual reproduction were accelerated by a few weeks, the ratio of the mature individuals has increased and the rhythm of the recurrence of young individuals in the population was changed. Vehement fluctuations in the numbers of oligochaetes were observed in the heated sector of the river.

7549 Effect of heated waters on biocenosis of the moderately polluted Narew River. Macrobenthos. Dusoge, K.; Wisniewski, R.J. (Polish Academy of Sciences, Lomianki, Poland). *Pol. Arch. Hydrobiol.;* **23**: No. 4, 539-554(1976).

The effect of a power station effluent on species composition, dynamics of the density of benthos was investigated in the lowland Narew River. A slight rise of water temperature, not higher than by 2°C in summer, was observed in the river downstream the power station. This gave in effect a decrease in the number of various species (especially Chironomidae) in the benthos, an increase of the share of predatory forms in the benthos and increased fluctuations in the numbers of benthic organisms. These changes indicate unfavorable decrease of the stability of benthic communities. Especially marked changes were observed in the sectors of the river under a combined effect of a higher water temperature and contamination of the waters with sewage and industrial effluents.

VERTEBRATES

REFER ALSO TO CITATION(S) 7462, 7466

7550 (BNWL—2289) **Thermal shock tolerances of six fishes and one invertebrate from the Pacific Northwest.** Young, J.W.; Apts, C.W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-06-1830. 12p. Dep. NTIS, PC A02/MF A01.

The purpose of this study was to ascertain the temperatures at which selected estuarine fishes from the Pacific Northwest and one of their potential food organisms would be incapacitated and killed after entering the thermal plume of an industrial cooling system. This information aids in impact evaluation of thermal discharges, especially where they act as barriers or entrapments. Data are presented from laboratory studies of equilibrium loss and thermal death as endpoints for different rates of temperature increase of six fishes and one invertebrate. The species tested were shiner perch, Cymatogaster aggregata; coho salmon, Onchorhynchus kisutch; Pacific sandlance, Ammodytes hexapterus; threespine stickleback, Gasterosteous aculeatus; silverspotted sculpin, Blepsias cirrhosus; Pacific staghorn sculpin, Leptocottus armatus; and the mysid, Mysis oculata collected from Sequim Bay, Washington. The null hypothesis that no differences exist between mean temperatures for equilibrium loss or death for different rates of temperature increase, allowing for possible effects of length and weight, was tested by analysis of covariance.

7551 Thermoregulatory responses to altering hypothalamic temperature in the harbor seal. Hammel, H.T.; Elsner, R.W.; Heller, H.C.; Maggert, J.A.; Bainton, C.R. (Univ. of California, San Diego). *Am. J. Physiol.;* **1**: No. 1, R18-R26(Jan 1977).

The rostral brainstem of the harbor seal Phoca vitulina was cooled and heated 33 to 41°C while oxygen consumption and rectal, hypothalamic flipper and dorsal skin temperatures were measured. These experiments were made on restrained seals at ambient temperatures -15 to 30°C. Cooling the preoptic and hypothalamic (POH) tissue increased oxygen consumption in a way that could be approximated by a linear regression line with slope and threshold temperature at which the metabolic rate was minimal. The slope of the regression line was a function of ambient temperature and rectal temperature. At each ambient temperature, the slope was significantly higher for lower rectal temperature. At all rectal temperatures, the slope was significantly higher for lower ambient temperature. The threshold hypothalamic temperatures did not vary consistently or significantly with either rectal temperature or ambient temperature. These results on the harbor seal are explicable by suggesting that the thermal-sensitive and reference neurons in the POH which regulate body temperature are inhibited equally by extrahypothalamic cold transducing neural elements.

7552 Physiological basis of habitat partitioning in Jamaican Eleutherodactylus. Pough, F.H. (Cornell Univ., Ithaca, NY); Stewart, M.M.; Thomas, R.G. *Oecologia (Berlin)*; **27**: 285-293(1977).

Rate of evaporation, resistance to drying, temperature selection, and critical thermal maximum were measured for Jamaican Eleutherodactylus acclimated to 20°C and a 12:12 L:D photoperiod. Two introduced species, E. planirostris and E. johnstonei, selected higher temperatures and had higher CTMs than two native species, E. cundalli and E. gossei. The introduced species lost water as rapidly as the native species, but tolerated 30 to 73 percent greater water loss before losing their righting response. The physiological differences are reflected in the microhabitat selection and activity patterns of the four species.

7553 Electrolytic method for determining oxygen dissociation curves using small blood samples: the effect of temperature on trout and human blood. Hughes, G.M.; O'Neill, J.G.; van Aardt, W.J. (Univ. of Bristol, Eng.). *J. Exp. Biol.;* **65**: No. 1, 21-38(Aug 1976).

Oxygen dissociation curves have been determined for trout blood and human blood at temperatures of 15 and 37°C. The relationship between P_{50} and temperature is similar to that obtained using other methods. Absolute values of P_{50} are generally lower than those obtained by other methods, especially in the case of fish blood. The effect of P/sub CO_2/ and pH on the oxygen dissociation curve of trout blood is tested and it is shown that P/sub CO_2/ has a more marked effect than pH when the other factor is maintained at a constant level. The Bohr factor appears to be approximately the same and independent of the P/sub CO_2/. The P_{50} of ray blood determined from fish during and after an operation showed an increased Bohr factor.

MAN

REFER ALSO TO CITATION(S) 7553

CHEMICALS METABOLISM AND TOXICITY

REFER ALSO TO CITATION(S) 5843, 5877, 5885, 7385

7554 (UCLA—12-1130) **Toxic effect of metals on DNA synthesis.** Korman, E.F.; Ward, J.F.; Myers, L.S. Jr. (California Univ., Los Angeles (USA)). 1977. Contract EY-76-C-03-0012. 20p. Dep. NTIS, PC A02/MF A01.

An in vitro DNA polymerase I system was used to study the effects of divalent metal ions on DNA replication/repair. The metals Ba^{++}, Ca^{++}, Cu^{++}, Co^{++}, Ni^{++}, Cd^{++}, Hg^{++}, Pb^{++}, and Zn^{++} increasingly inhibited DNA polymerization in the order listed. BSA had a profound effect in the system, abolishing the inhibitory effect of Cd^{++}. DNA primer-template at sufficiently high levels abolished Cd^{++} inhibition. Adjustment of mononucleotide levels gave rise to a multiphasic inhibition pattern. The interpretation of these findings with respect to toxicity levels of divalent metals is discussed.

7555 Heavy metal tolerance of marine phytoplankton. III. Combined effects of copper and zinc ions on cultures of four common species. Brack, G.S. (Univ. of Trondheim, Norway); Jensen, A.; Mohus, A. *J. Exp. Mar. Biol. Ecol.;* **25**: 37-50(1976).

The combined effects of copper and zinc ions on the growth of three marine diatoms and one dinoflagellate in culture have been studied. The two metals were found to act synergistically to all algae except Phaeodactylum tricornutum Bohlin. With this species an antagonistic effect was observed. Addition of zinc ions reduced the inhibition of growth caused by the more toxic copper ions. Zinc toxicity to this alga increased at low concentration of magnesium, indicating a common route for divalent metal ions in general.

7556 Effect of manganese on neonatal rat: manganese distribution in vital organs. Husain, R.; Mushtaq, M.; Seth, P.K.; Chandra, S.V. (Industrial Toxicology Research Centre, Lucknow, India). *Chemosphere;* **5**: No. 5, 395-399(1976).

At present very little is known about the effect of manganese on the early stage of life, though the metal poisoning in adult humans and experimental animals has been known for quite some time. The possibility of the exposure of the general public to the deleterious effects of the metal through the environmental contamination resulting from its increasing industrial applications, and the use of Methyl Cyclopentadienyl Manganese Tricarbonyl (MMT) in gasoline and motor fuel, points to the need for such an information. Our recent studies in this direction have shown that manganese exposed nursing dams can transfer significant amounts of the metal via maternal milk of their sucklings and the brain of the latter exhibited marked enzymatic alterations. The present communication deals with the distribution of manganese in the vital organs of rat pups nursing on mothers receiving the metal orally.

CELLS

7557 (LA—6976-PR) **Altered growth and RNA metabolism in cultured Chinese hamster ovary cells exposed to low levels of cadmium. Progress report, July 1, 1976—June 30, 1977.** Hildebrand, C.E.; Enger, M.D.; Deaven, L.L.; Campbell, E.W.; Jones, M.; Barrington, H.L.; Hanners, J.L.; Saponara, A.G. (Los Alamos Scientific Lab., N.Mex. (USA)). Sep 1977. Contract W-7405-ENG-26. 9p. Dep. NTIS, PC A02/MF A01.

This report summarizes measurements of the uptake and intracellular distribution of cadmium in cultured Chinese hamster cells exposed to $CdCl_2$ at growth medium concentrations ranging from 2×10^{-7} M Cd^{++}, which shows no effect on cell proliferation, to 3×10^{-6} M Cd^{++}, which stops cell division within 24 h after beginning exposure. These studies demonstrate a rapid accumulation of intracellular cadmium during the first 24 h of growth in Cd^{++}-containing medium.

MICROORGANISMS

REFER ALSO TO CITATION(S) 7428, 7429

7558 Toxic effect of water-soluble fractions of crude, refined, and weathered oils on the growth of a marine bacterium. Griffin, L.F.; Calder, J.A. (Flordia State Univ., Tallahassee). *Appl. Environ. Microbiol.;* **33**: No. 5, 1092-1096(May 1977).

The water-soluble fractions of three crude and two refined oils reduced the growth rate and maximum cell density of the marine bacterium Serratia marinorubra grown in batch culture. The weathering of a crude and a refined oil was simulated in the laboratory. The water-soluble fractions remaining from this process were more toxic to S. marinorubra than were the parent unweathered oils. Increases in the magnitude of toxic effect of 3 to 30 times were observed as a function of decreasing the concentration of yeast extract in the cultures from 0.1 to 0.05 and 0.01%. The toxicity did not correlate with the concentration of total water-soluble fraction or of aromatic hydrocarbons in the water-soluble fraction. Affected cultures did not exhibit a residual toxicity after being back-inoculated into control media.

7559 Effect of cadmium on fungi and on interactions between fungi and bacteria in soil: influence of clay minerals and pH. Babich, H.; Stotzky, G. (New York Univ.). *Appl. Environ. Microbiol.;* **33**: No. 5, 1059-1066(May 1977).

Fungi (Rhizopus stolonifer, Trichoderma viride, Fusarium oxysporum f. sp. conglutinans, Cunninghamella echinulata, and several species of Aspergillus and Penicillium) tolerated higher concentrations of cadmium (Cd) when grown in soil than when grown on laboratory media, indicating that soil mitigated the toxic effects of Cd. In soil amended with clay minerals, montmorillonite provided partial or total protection against fungistatic effects of Cd, whereas additions of kaolinite provided little or no protection. Growth rates of Aspergillus niger were inhibited to a greater extent by 100 or 250 μg of Cd per g in soil adjusted to pH 7.2 than in the same soil at its natural pH of 5.1. However, there were no differences in the growth rates of Aspergillus fischeri with 100 or 250 μg of Cd per g in the same soil, whether at pH 5.1 or adjusted to pH 7.2. Growth of A. niger and A. fischeri in a soil contaminated with a low concentration of Cd (i.e., 28 μg/g), obtained from a site near a Japanese smelter, did not differ significantly from growth in a soil collected some distance away and containing 4 μg of Cd per g. Growth of A. niger in sterile soil amended with 100 μg of Cd per g and inoculated with Bacillus cereus or Agrobacterium tumefaciens was reduced to a greater extent than in the same soil containing 100 μg of Cd per g but no bacteria. The inhibitory effects of Agrobacterium radiobacter to A. niger were slightly reduced in the presence of 100 μg of Cd

per g, whereas the inhibitory effects of Serratia marcescens were enhanced.

7560 Effects of ozone and sulfur dioxide on virus growth in mice. Fairchild, G.A. *Arch. Environ. Health;* 32: No. 1, 28-33(1977).

Inhalation of ozone and sulfur dioxide inhibited influenza virus growth in the nose of mice. Ozone inhalation caused the more pronounced inhibition of influenza virus growth: 0.6 ppM ozone for 3 hours post-virus exposure almost completely inhibited influenza virus growth in the nose, whereas sulfur dioxide (6 ppM for 7 days) caused only partial inhibition of influenza growth in the nose. Neither gas altered the propagation of influenza virus in the lungs of mice. Vesicular stomatitis virus (VSV) growth was either unaffected by exposure to ozone (0.9 ppM for 3 hours) or, when ozone exposure preceded VSV exposure, the virus may have grown to slightly higher titer. The inhibitory effect of ozone and sulfur dioxide on influenza virus growth in nasal epithelium suggests a competitive interaction between the chemical inhalant, the virus, and host tissues, with net consequences for the pathogenesis of this disease. If the effects of these inhalants are to be properly interpreted, they should be determined for all major regions of virus growth and inhalant deposition.

PLANTS

REFER ALSO TO CITATION(S) 6428, 6436, 7428, 7429, 7435, 7437, 7443, 7450, 7473, 7559, 7572

7561 Uptake, distribution, and effect of cadmium and lead in plants. Koeppe, D.E. (Univ. of Illinois, Urbana). *Sci. Total Environ.;* 7: No. 3, 197-206(May 1977).

Lead and cadmium have been dispersed into the environment in increasing concentrations over the last century. In most instances this dispersal has been highly localized. This localization, along with reports of Pb and Cd toxicity to a variety of organisms in many food chains, amplifies the need for more knowledge about the uptake, distribution, and effects of these metals in primary producers. Because both Pb and Cd are tightly bound to both organic and inorganic surfaces, their movement into and through plants is largely affected by environmental conditions surrounding the plants, as well as the physiological condition of the plants. The paper reviews the uptake, translocation, and effect of Pb and Cd in corn, soybeans, and several other agronomic species. Cadmium is more toxic to both corn and soybeans than is Pb, and soybeans are more susceptible to both Cd and Pb than is corn. Binding and mobility properties are thought to be largely responsible for these differences.

7562 Uptake of heavy metals by a copper-tolerant fungus, Penicillium ochro-chloron. Okamoto, K.; Suzuki, M.; Fukami, M.; Toda, S.; Fuwa, K. (Tokyo Univ.). *J. Toxicol. Environ. Health;* **41**: No. 1, 17-22(Jan 1977).

A strain of Penicillium ochro-chloron having a highly tolerance to copper has a similar tolerance to zinc, manganese, iron, lead and cadmium, but has sensitivity to mercury, nickel and cobalt. The cellular contents of copper and zinc in the fungus leveled off in the cases of media containing higher concentrations of copper and zinc. These constant uptakes were particular characteristics with copper and zinc, whereas they were not observed with nickel and cobalt. Marked reduction of the cellular contents of potassium and magnesium was observed in the cases of higher concentrations of copper and zinc in the media.

7563 Interactions of lead and cadmium on metal uptake and growth of corn plants. Miller, J.E. (Univ. of Illinois, Urbana); Hassett, J.J.; Koeppe, D.E. *J. Environ. Qual.;* **6**: No. 1, 18-20(1977).

Short term plant accumulation and growth effects of Pb and Cd added to soil separately and in combination were investigated with corn (Zea mays L., Wf9 x M14) grown in a loamy sand under greenhouse conditions. A tendency for soil Pb to increase both the plant Cd concentration and the total Cd uptake of the corn shoots was observed. Conversely, soil Cd reduced the total Pb uptake and in some cases the Pb concentration in the corn shoots. Both Pb (125 and 250 μg/g soil) and Cd (2.5 and 5 μg/g soil) reduced the vegetative growth of the corn shoots, and a positive interaction of the two metals on growth was noted.

7564 Emission and deposition of petrol engine exhaust Pb. I. Deposition of exhaust Pb to plant and soil surfaces. Little, P.; Wiffen, R.D. (AERE, Harwell, Eng.). *Atmos. Environ.;* **11**: No. 5, 437-447(1977).

^{203}Pb was used in the preparation of radioactively labelled petrol-engine exhaust aerosols. Wind-tunnel experiments using leaves from 11 species of trees showed that rough or hairy leaf surfaces collected exhaust ^{203}Pb up to 8 times more efficiently than smooth leaf surfaces. The leaf laminas, petioles and stems of intact shoots of Beech, White poplar, and Nettle showed marked differences in Pb collection efficiencies due to differences in size, shape and surface texture of the plant parts. Fresh exhaust aerosols showed higher deposition velocities than the aggregated (aged) aerosols due to the higher diffusivity of the finer exhaust particles. Deposition velocities of exhaust ^{203}Pb were also measured to moss-bags, grass, soil and filter-paper surfaces, and were shown to increase with wind-speed. Results obtained in the wind-tunnel were compared with measurements of Pb deposition and dispersion from the M.4 motorway. Less than 10 percent of the Pb emitted from the motorway appeared to be deposited within 30 m of the motorway.

7565 Decomposition of vegetation growing on metal mine waste. Williams, S.T.; McNeilly, T.; Wellington, E.M.H. (Univ. of Liverpool). *Soil Biol. Biochem.;* **9**: No. 4, 271-275(1977).

Aspects of the decomposition of metal tolerant vegetation growing on mine waste containing high concentrations of lead and zinc were studied and compared with those on an adjacent uncontaminated site. High concentrations of Pb and, to a lesser extent, Zn, accumulated in metal-tolerant grass. Retarded decomposition of this vegetation as compared with that on the uncontaminated site was indicated by a greater accumulation of litter, less humus formation, reduced soil urease activity and smaller microbial and microfaunal populations. Some evidence for increased metal tolerance in microbes from the mine waste was obtained. Concentrations of lead tolerated under laboratory conditions were much lower than those extracted from the mine waste and its vegetation, probably due to the lack of an accurate method for assessing the availability of lead in soil and vegetation.

7566 Stress ethylene evolution: a measure of ozone effects on plants. Tingey, D.T.; Standley, C.; Field, R.W. (Environmental Protection Agency, Corvallis, OR). *Atmos. Environ.;* **10**: No. 11, 969-974(1976).

To determine if ethylene evoluton by plants was correlated with ozone stress, a range of plant species and cultivars was exposed to varying ozone concentrations. Following exposure, the plants were encapsulated in plastic bags and incubated for up to 22 h. The stress-induced ethylene that accumulated in the bag was monitored and correlated with the effects of ozone on plants. The rate of stress-induced ethylene production as a function of ozone concentration was used as a measure of plant sensitivity. Applying this Rankine scale, ponderosa pine, eucalyptus and soybean were the most sensitive species; holly, squash and marigold were least sensitive. There was a good correlation between ozone-induced stress ethylene production and foliar injury. However, the coefficient of variability associated with the ethylene determination was substantially less than with the visual injury estimate. The production of stress-induced ethylene generally lasted for less than 48 h following exposure. The measurement of stress ethylene appeared to be a fast, reliable, sensitive and reproducible technique to measure ozone stress on plants.

7567 Problem of environmental pollution in rural areas of Gifu Prefecture. Iwanaga, T. *Nihon No Kagakusha;* **10**: No. 7, 329-332(Jul 1975). (In Japanese).

A problem of untimely defoliation of Japanese pear trees in orchards of Kamo City, Gifu Prefecture which occurred in the summer of 1971 was investigated. The damage to leaves began from both the apex and the periphery as discoloration and then proceeded to the central part. The cause of the untimely defoliation was suspected to be fluoride-containing exhaust from a tile factory. Experiments in which pear leaves were exposed to aqueous hydrogen fluoride solution revealed the accumulation of fluorine in pear leaves, and the major cause of the untimely defoliation was thus attributed to fluoride in the exhaust from the tile factory and also to sulfur dioxide.

7568 Studies on the injuries of crops by harmful gases under covering. II. On the mechanism of crop injury due to gaseous nitrogen dioxide. Kato, T.; Tachibana, S.; Inden, T. *Seibutsu Kankyo Chosetsu;* **12**: No. 4, 103-107(Dec 1974). (In Japanese).

The mechanism of crop injury by nitrogen dioxide gas was investigated by exploring kidney bean, cucumber, tomato, egg plant, and spinach plants 6.0 to 17 ppM NO_2 under various conditions. The application of aqueous oxyethylene decasanol on crop leaves reduced the injury due to the gas, expecially on the lower leaf sides. Leaves exposed to NO_2 in the dark showed severer injury and contained more nitrite anion than those exposed to NO_2 in the light. Leaves smeared with an aqueous sodium nitrite solution showed the same type of injury as that induced by NO_2. After treatment with 3-(3,4-dichlorophenyl)-1,1- dimethylurea, the leaves became more susceptible to the gas even under light and formed more nitrite anion than controls. Plants grown in nitrate-nitrogen cultures were less susceptible to NO_2 damage than those grown in ammonia-nitrogen cultures or cultures without nitrogen and contained less nitrite anion than others. Plant injury by gaseous nitrogen dioxide appeared to be caused by nitrite anion. Susceptibility to NO_2 depended on the amount of the gas taken in by stomata and on the physiological activity of the plant which reduces the anion. The reduction is carried out by nitrite reductase. The photochemical reduction by reductase in chloroplasts appears to be related to the injury-reducing effect of light.

7569 Studies on the injuries of crops by harmful gases under covering. I. Injuries of vegetables by gaseous nitrogen dioxide and the conditions affecting crop susceptibility. Kato, T.; Tachibana, S.; Inden, T. *Seibutsu Kankyo Chosetsu;* **12**: No. 3, 87-92(Sep 1974). (In Japanese).

The effects of environmental conditions such as soil-moisture humidity, and light on injuries to crops such as kidney bean, cucumber, tomato, and egg plant as well as the relationships between injury occurrence and plant nutrition, age of seedlings, and leaf position were investigated when the crops were exposed to gaseous nitrogen dioxide under a covering. The injury was severer when the soil moisture was richer and the humidity was higher. Injury was greater under dark conditions as opposed to light conditions before, during, and after NO_2 exposure. The first leaves of kidney bean plants were more susceptible to the gas when they were younger. Leaves with active metabolism (in the middle position) were the most susceptible to NO_2. Vegetables grown in fields or cultures poor in nitrogen were apparently susceptible to the gas, and those grown in ammonia-nitrogen rich cultures were more severely injured than those grown on nitrate-nitrogen rich cultures. Those grown in iron-deficient cultures were more susceptible to NO_2 than controls.

INVERTEBRATES

REFER ALSO TO CITATION(S) 7454, 7455, 7456, 7459, 7490, 7592

7570 Trace elements in Acartia clausi from Elefsis Bay of the upper Saronikos Gulf, Greece. Zafiropoulos, D.; Grimanis, A.P. (Nuclear Research Centre, Athens). *Mar. Pollut. Bull.;* **8**: No. 4, 79-81(Apr 1977).

Twelve trace elements (antimony, arsenic, cadmium, chromium, cobalt, copper, iron, manganese, mercury, scandium, selenium and zinc) were determined by neutron activation analysis in a planktonic copepod (Acartia clausi) from Elefsis Bay of the Upper Saronikos Gulf, Greece. During the first cruise (January 1974) higher levels of most of these trace elements were found in this copepod collected from a polluted area of the bay. This trend however was not observed during the second cruise (February 1974) possibly due to the termination of the active vertical convection. Lower levels of cobalt, similar levels of iron and slightly increased levels of chromium were found in Elefsis Bay Acartia clausi from those reported in Acartia clausi from the Bay of Roquebrune. Slightly increased concentrations of antimony and zinc as well as lower concentrations of arsenic and cadmium were found in Acartia clausi than those reported in other Copepoda. No significant differences were found for copper, manganese and mercury. More data are needed to confirm if higher levels of antimony, chromium and zinc found in Acartia clausi are due to the pollution of the bay.

7571 Contamination of biological samples by ingested sediment. Flegal, A.R.; Martin, J.H. (Oregon State Univ., Corvallis). *Mar. Pollut. Bull.;* **8**: No. 4, 90-92(Apr 1977).

An inorganic residue, presumed to be ingested sediment, was found in the rocky intertidal gastropods Tegula funebralis and Acmaea scabra and the estuarcopepods Acartia tonsa and A. clausi. When expressed as a percentage of the sample weight, this residue fraction often correlated significantly with the elemental concentrations measured in the organisms.

7572 Heavy metal accumulation in the vicinity of a desalination plant. Romeril, M.G. (Reading Bridge House, Eng.). *Mar. Pollut. Bull.;* **8**: No. 4, 84-87(Apr 1977).

The brine effluent produced by a flash distillation desalination plant contains elevated levels of some heavy metals. The effluent produced from such a plant operating in Jersey during the summer months leads to increased metal concentrations in limpets and some Fucus species. This is most evident with copper which remains at elevated levels during the winter period of plant inactivity, probably due to the copper coating retained on boulders and pebbles on the upper shore.

7573 Behavioural effects of mercury on grass shrimp. Barthalmus, G.T. (North Carolina State Univ., Raleigh). *Mar. Pollut. Bull.;* **8**: No. 4, 87-90(Apr 1977).

Subacute exposure (0.05 ppM) to mercuric chloride significantly impairs the conditioned avoidance responses of grass shrimp, Palaemonetes pugio Holthuis, when tested in an aquatic avoidance apparatus. Control animals learn to avoid a shock after the onset of a light which followed a period of dark-adaptation. A third group of shrimp, which establish an avoidance curve similar to the controls, quickly lose its ability to avoid being shocked when exposed to mercury in the final days of the experiment. These experiments demonstrate the value of a simple behavioural index for establishing subacute toxicity standards for organisms in aquatic ecosystems.

7574 Survival of two species of amphipods in aqueous extracts of petroleum oils. Lee, W.Y.; Welch, M.F.; Nicol, J.A.C. (Univ., of Texas, Port Aransas). *Mar. Pollut. Bull.;* **8**: No. 4, 92-94(Apr 1977).

Aqueous extracts of two petroleum oils, No. 2 fuel oil and Southern Louisiana crude, were tested on two amphipods, Gammarus mucronatus and Amphithoe valida, for survival. The oils were toxic at concentrations of 0.8 ppM (fuel oil) and 2.4 ppM (S. Louisiana crude). Mortalities increased with the concentration and length of exposure. Few or no young were produced at these and higher concentrations (breeding adults were decreasing rapidly in numbers). The amphipods are more sensitive to aqueous extracts of these oils than benthic polychaetes and shrimp, for which data are available.

7575 Acute toxicities of selected heavy metals to the softshell clam, Mya arenaria. Eisler, R. (Environmental Research Lab., Narragansett, RI). *Bull. Environ. Contam. Toxicol.;* **17**: No. 2, 137-145(Feb 1977).

Static acute toxicity bioassays with adult softshell clams and salts of copper, cadmium, zinc, lead, manganese, and nickel were conducted at 30‰ salinity and 22°C. Concentrations fatal to 50% in 168 hours, in mg/l (ppm) metal added at start, were 0.035 for Cu, 0.150 for Cd, 1.55 for Zn, 8.80 for Pb, 300.0 for Mn, and >50.0 for Ni. Additional tests were conducted with Zn^{2+} and Cu^{2+} at 30‰ during fall (17.5°C) and winter (4°C); clams displayed increasing survival with decreasing temperature. For Cu, LC-50 (336 hr) values at 17°C and 4°C were 0.086 and >3.00 mg/l, respectively; for Zn these were 2.65 and >25.0, respectively.

7576 Heavy metals in macroinvertebrates and fish from the lower Medway estuary, Kent. Wharfe, J.R.; van den Broek, W.L.F. (Sir John Cass. School of Science and Tech., London). *Mar. Pollut. Bull.;* **8**: No. 2, 31-34(Feb 1977).

Since the Second World War, expansion of the Medway towns of Rochester, Chatham and Gillingham and industrial development in this area have increased the threat of pollution in the lower estuary. During ecological studies on the lower Medway estuary, macroinvertebrates and fish were analyzed for five heavy metals, mercury, zinc, copper, lead and cadmium, periodically from April 1973 to January 1976. In the absence of previous work of this kind in the area, this paper sets out the results and discusses their significance.

7577 Heavy metal complexation in polluted molluscs. I. Limpets (Patella vulgata and Patella intermedia). Howard, A.G.; Nickless, G. (Univ. of Southampton, Eng.). *Chem.-Biol. Interact.;* **16**: No. 1, 107-114(Jan 1977).

The accumulation of cadmium, zinc and copper by the marine gastropod molluscs Patella vulgata and Patella intermedia has been studied by gel permeation chromatography of water-soluble extracts of environmentally contaminated shellfish. A major proportion of the water-soluble cadmium and copper in these molluscs is associated with a protein of molecular weight 10,800 daltons. Evidence is presented supporting the similarity of this protein with mammalian metallothionein. This protein contained only a small proportion of the zinc found in the samples.

7578 Effect of heavy metals on hatching of brine-shrimp eggs. Saliba, L.J.; Kyzyz, R.M. (Royal Univ. of Malta, Msida). *Mar. Pollut. Bull.;* **7**: No. 10, 181-182(Oct 1976).

The effects of heavy metals on marine organisms are currently being studied not only in terms of acute toxicity, but also insofar as they affect natural life-processes at sub-lethal levels, as such levels are more commonly encountered in polluted waters. Growth retardation and interference with reproductive success have been among the most common aspects.

7579 Observations on the availability of lead, zinc, cadmium, and copper in woodland litter and the uptake of lead, zinc, and cadmium by the woodlouse, Onisucs asellus. Martin, M.H.; Coughtrey, P.J.; Young, E.W. (Univ. of Bristol, Eng.). *Chemosphere;* **5**: No. 5, 313-318(1976).

Recent studies have compared the levels of lead, zinc and cadmium in terrestial invertebrates from contaminated and non-contaminated environments. Cadmium was shown to be accumulated by certain invertebrates to a greater extent than either lead or zinc when compared to the levels of metals in the animal's food material. The paper provides preliminary information on one possible reason for this phenomenon.

7580 Heart transaminase in the rock crab, Cancer irroratus, exposed to cadmium salts. Gould, E.; Collier, R.S.; Karolus, J.J.; Givens, S. (Milford Lab., CT). *Bull. Environ. Contam. Toxicol.;* **15**: No. 6, 635-643(1976).

When rock crabs, Cancer irroratus, were exposed for 4 days to 1 ppM cadmium as the chloride salt, aspartate aminotransferase activity in heart muscle preparations increased significantly over heart AAT in the control crabs. When crabs were exposed to 1 ppM cadmium as the nitrate salt in analogous experiments, however, the heart AAT was slightly depressed, but not to a significant degree. That the nitrate salt of cadmium did not produce the same effect as the chloride salt underscores the importance of the form in which a

metal occurs in the environment. Metal ions bind to various ligands, metabolic and otherwise, to an extent largely dependent upon the nature of their immediate chemical association. The results reported here clearly indicate that cadmium is more toxic as the chloride salt than as the nitrate. Data indicate that some enzymes in metal exposed animals may develop a degree of tolerance to higher-than-normal concentrations of cations, a tolerance that may lessen the necessary sensitivity to biochemical modulators, such as magnesium.

7581 Feeding behavior of Mytilus edulis in the presence of methylmercury acetate. Dorn, P. (Texas A and M Univ., College Station). *Bull. Environ. Contam. Toxicol.;* **15**: No. 6, 714-719(1976).

Mercury was shown to have a harmful effect upon feeding in the mussels tested. A decline in feeding was shown as the mercury concentrations were increased. Respiration was found to increase with increasing mercury concentration in Congeria (DORN, 1974). The decrease in feeding of Mytilus with increasing mercury concentration can be related to stress on the animal's physiological state. It has been found that the nervous system controls ciliary activity in Mytilus. It is possible that since mercury inhibits nervous activity (Webb, 1966), decreased feeding may be caused by disruption of ciliary activity. The results of this study have shown the severe effect of methyl mercury upon one aspect necessary for life functions in living organisms. Decreased feeding rates can be an indication of toxicity of an environment to its inhabitants.

VERTEBRATES

REFER ALSO TO CITATION(S) 7446, 7448, 7485, 7514, 7576

7582 (LF—56, pp 66-70) **Air flow distribution patterns in a 27-inch chronic inhalation exposure chamber.** Beethe, R.L.; Carpenter, R.L. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Air flow distribution patterns in a 27-inch Rochester-type inhalation exposure chamber were studied using a heated, thin-film anemometer probe and smoke injection. These patterns and their effect on aerosol concentrations and size distributions across the chamber were studied and found to be significantly nonuniform across the chamber volume. The chambers were then modified by adding an inlet diffusing screen and a distributed exhaust system to achieve plug flow through the chamber and corresponding uniform aerosol concentrations.

7583 (LF—56, pp 71-76) **Microprocessor: controlled inhalation exposure system.** Carpenter, R.L.; Barr, F.P.; Leydig, R.L.; Rajla, R.E. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

A microprocessor controlled inhalation exposure system (MCIES) has been built to automate aerosol generation, exposure time and aerosol sampling for animal toxicity studies. The system has a time resolution of 0.1 second and automatically sequences the exposure events from initiation to termination of the exposure. The operator is required to preset all airflows, read in a paper tape containing the time sequence of events and initiate the automatic sequence by closing a switch.

7584 (LF—56, pp 123-125) **Retention and distribution of inhaled, neutron-activated fly ash in the syrian hamster.** Brooks, A.L.; Carpenter, R.L.; Harpaz, R. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Syrian hamsters received a single. nose-only inhalation exposure using neutron-activated fly ash. The major isotopes present in the activated fly ash that were useful for gamma-counting were ^{46}Sc, ^{131}Ba, ^{124}Sb and ^{59}Fe. The fly ash aerosol had an AMAD of 2.9 μm and a sigma/sub g/ of 1.6. Whole-body retention of the fly ash was described by the three component exponential equation y = 64e/sup -1.2t/ + 28e/sup -0.30t/ + 8e/sup -0.0084t. Thus, about 10% of the initial body count was retained with a half-life of 83 days. This half-life was similar to that seen in Syrian hamsters that inhaled $^{144}CeO_2$. By 20 days after inhalation, over 90% of the total body burden was in the lungs. At 8 days after exposure, about 25% of the initial lung burden was removed when animals were subjected to lung lavage. This preliminary study illustrates that neutron activation is a useful technique for studying the fate of inhaled fly ash and should be useful in future bioeffects experiments to characterize deposition, retention and dose of the particulate material.

7585 (LF—56, pp 143-146) **Varibility of internal organ doses in individuals inhaling toxic substances.** Cuddihy, R.G. Dec 1976.

In Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976.

Within a group of individuals exposed to the same concentration of an aerosol, there will be substantial variation among the doses received by the individual members. Variations of this type are important to the research toxicologist studying the relationship between the dose of toxic materials and the biological effects in a similarly exposed group of experimental animals. They are also important to those responsible for using experimental data to develop standards for controlling environmental exposures of human populations. These variabilities are due to differences in anatomical and physiological parameters among individuals and occur in both animal and human populations. This analysis suggests that doses received by individuals in such populations will be distributed log-normally with a geometric standard deviation of about 2.1. On this basis, about 2.5% of the individuals will receive more than 4.4 times the average dose for a group exposed to the same quantity of aerosol.

7586 Methylmercury: effect on serum enzymes and humoral antibody. Koller, L.D. (Oregon State Univ., Corvallis); Exon, J.H.; Arbogast, B. *J. Toxicol. Environ. Health;* **2**: No. 5, 1115-1123(May 1977).

Dosages of 20 and 10 ppM methylmercury were toxic to rabbits while 1 ppM did not produce clinical signs or death. Serum alkaline phosphatase levels were elevated in all rabbits exposed to methylmercury. Methylmercury-exposed rabbits challenged to A/PR8 influenza virus had hemagglutination inhibition titers as much as four times lower than those of controls. Histopathologic lesions were found in the cerebellum of rabbits that died. The most significant features of this study were that methylmercury chloride suppressed the humoral immune system and resulted in increased serum alkaline phosphatase levels, which may aid in diagnosis when methylmercury poisoning is suspected.

7587 Hepatic mixed-function oxidase activity in mice treated with methylated benzenes and methylated naphthalenes. Fabacher, D.L.; Hodgson, E. (North Carolina State Univ., Raleigh). *J. Toxicol. Environ. Health;* **2**: No. 5, 1143-1146(May 1977).

Eight methylated benzene and five methylated naphthalene compounds were injected ip into adult male mice daily for 3 days. On the fourth day livers from control and treated mice were compared with regard to weight, microsomal N- and O-demethylase activity, and various spectral characteristics of microsomal cytochrome P-450. Three methylated benzenes and one methylated naphthalene produced significant increases in liver weight/body weight ratios, O-demethylation of p-nitroanisole, N-demethylation of aminopyrene, or a combination of these.

7588 Thermodynamics and toxicity of sulfuric acid mists. Cavender, F.L.; Williams, J.L.; Steinhagen, W.H.; Woods, D. (Becton, Dickinson and Co. Research Center, Research Triangle Park, NC). *J. Toxicol. Environ. Health;* **2**: No. 5, 1147-1159(May 1977).

The hygroscopic nature of sulfuric acid mist has not been totally appreciated in previous toxicological work. Sulfuric acid mist, by adsorption or desorption of water, equilibrates rapidly with the relative humidity of its environment. The measured particle diameters of a given sulfuric acid mist will increase in size as the particles adsorb water on entering the respiratory tract. For a dry climate of 5% relative humidity, sulfuric acid mist particles will triple in size in the respiratory tract. At 60% relative humidity, particles will double in size, while particles in humid regions will increase very little. In the respiratory tract, the particles will deposit according to their size at 98% relative humidity. In order to compare toxicity data for sulfuric acid mist, relative humidity must be carefully recorded throughout the experimental procedure.

7589 Stimulation of DNA synthesis in the lungs of hamsters exposed intermittently to nitrogen dioxide. Creasia, D.A.; Nettesheim, P.; Kim, J.C.S. (Oak Ridge National Lab., TN). *J. Toxicol. Environ. Health;* **2**: No. 5, 1173-1181(May 1977).

Stimulation of [^{3}H] thymidine incorporation in the lungs of hamsters exposed singly and repeatedly to 10 ppM NO_2 was studied. Within 24 hr of the first exposure to NO_2, the response was characterized by a marked increase in [^{3}H] thymidine labeling in the bronchi, bronchioles, and alveolar ducts, but not in the trachea or the peripheral alveoli. If, after the first NO_2 exposure, subsequent exposures were repeated daily, no further stimulation of [^{3}H] thymidine incorporation was observed in any part of the respiratory tract. However, if the interval between the first and subsequent exposures was 2-3 days rather than 1 day, stimulation of [^{3}H] thymidine incorporation was observed in the bronchi, bronchioles, and alveolar ducts for up to 21 NO_2 exposures. A significantly greater increase in [^{3}H] thymidine incorporation was observed when the interval between subsequent exposures was extended to 7 days. However, no repeated exposure, whether at 2-3 or 7 day intervals, was as effective as the first NO_2 exposure in stimulating incorporation of vertical bar [^{3}H] vertical bar thymidine.

7590 Effect of nickel sulphate on male rats. Mathur, A.K.; Datta, K.K.; Tandon, S.K.; Dikshith, T.S.S. (Industrial Toxicology Research Centre, Lucknow, India). *Bull. Environ. Contam. Toxicol.;* **17**: No. 2, 241-248(Feb 1977).

Cytopathological and histopathological changes in skin, liver, kidney and testis of rats due to nickel sulfate have been studied

experimentally. Skin of nickel sulfate painted rats showed hyperkeratinization, vacuolization, hydropic degeneration of basal layer and atrophy of epidermis. The testis showed degeneration and edema of seminiferous tubules, while liver showed areas of focal necrosis, congestiion and dilatation of sinusoids.

7591 Protective action of selenium against mercury in northern creek chubs. Kim, J.H.; Birks, E.; Heisinger, J.F. (Univ. of South Dakota, Vermillion). *Bull. Environ. Contam. Toxicol.;* **17**: No. 2, 132-136(Feb 1977).

Selenium dioxide was shown to be an effective antagonist to the toxic effects of mercuric chloride in the northern creek chub (Semotilus atromaculatus). Selenium pretreatment increased the whole body accumulation of mercury at lower environmental Hg concentrations. It decreased mercury accumulation in survivors at higher, acutely toxic concentrations.

7592 Distribution and abundance of heavy metals in finfish, invertebrates and sediments collected at a deepwater disposal site. Greig, R.A.; Wenzloff, D.R.; Pearce, J.B. (Sandy Hook Lab., Highlands, NJ). *Mar. Pollut. Bull.;* **7**: No. 10, 185-187(Oct 1976).

Analyses of deep water finfish to several heavy metals indicate that deep water fish have less metal in muscle tissue than do fish taken from the continental shelf. Liver tissue from deep water fish also, generally, contain less metals. Sediments and a single invertebrate collected at deep water stations have also been analyzed for heavy metals.

7593 Distribution of heavy metals in tissues of the common seal. Roberts, T.M.; Heppleston, P.B.; Roberts, R.D. (Univ. of Liverpool). *Mar. Pollut. Bull.;* **7**: No. 10, 194-196(Oct 1976).

The lead, cadmium and mercury content of soft tissues and bone were determined for the common seal (Phoca vitulina) collected from off the coast of East Anglia and the West of Scotland. Lead levels were low in all tissues, cadmium accumulated with age in the kidney of West Scotland seals and mercury accumulated to high levels in the liver of seals from both areas. Comparison of our results with those of other workers suggests that the rate of mercury accumulation in the liver of seals increases in the order: Canadian Arctic and Atlantic coast less than West Scotland less than East Anglia less than Netherlands coast. Accumulation of mercury in the kidney and spleen of older seals lends tentative support to the hypothesis that a protective demethylation and retention process in the liver may begin to leak mercury to other tissues at the high concentrations which have been recorded in the liver of older seals, and at the high dose rates which have been used in toxicological experiments.

7594 Role of iron deficiency in inducing susceptibility to manganese toxicity. Chandra, S.V.; Shukla, G.S. (Industrial Toxicology Research Centre, Lucknow, India). *Arch. Toxikol.;* **35**: No. 4, 319-323(1976).

Daily intraperitoneal administration of manganese chloride (15 mg/kg) to rats, maintained on an iron deficient diet, produced marked alterations in the activity of succinic dehydrogenase, monoamine oxidase, and in the morphology of the liver. Manganese accumulation was also significantly increased in such rats after similar treatment to normally fed rats. Iron deficiency leads to increased absorption of manganese which is responsible for increased suceptibility to manganese toxicity in these animals.

7595 Mechanism of the effects of water hardness on the lethality of heavy metals to fish. Zitko, V.; Carson, W.G. (Environment Canada, St. Andrews, New Brunswick). *Chemosphere;* **5**: No. 5, 299-303(1976).

The lethality of heavy metals to fish decreases with increasing water hardness. This effect is usually attributed to the complexing of the toxic cations and to a low toxicity of the resulting complexes (e.g., cupric carbonate). The stability constant of this complex agrees reasonably well with that derived from lethality data. On the other hand, a much stronger binding of other cations would be required to explain the decrease of their lethality with increasing water hardness by this mechanism. Competition for active sites in fish tissues between the toxic cations and those of calcium and magnesium may be another mechanism of the effects of water hardness on the lethality of heavy metals to fish. The paper demonstrates that competition between magnesium and zinc ions affects the lethality of the latter. As expected from the competition equilibria, calcium has no effect on the lethality of zinc. Similarly, neither magnesium nor calcium affects the lethality of copper. The lethality of cadmium appears to be due to a more specific binding than that of zinc and is not affected by magnesium.

7596 Chelation in metal intoxication. V. Lowering of manganese content in poisoned rat organs. Tandon, S.K.; Mathur, A.K. (Industrial Toxicology Research Centre, Lucknow, India). *Chemosphere;* **5**: No. 5, 319-325(1976).

Metal chelation has been considered useful in the management of manganese poisoning to a considerable extent. Our own studies in this direction have shown that some polyaminocarboxylic acids and a few amino acids are effective in not only removing manganese from the vital organs of experimentally poisoned animals but also in restoring certain metal induced biochemical and histological changes in such organs. Further, the success of p-aminosalicylic acid (PAS), a chemotherapeutic agent for tuberculosis, in manganese mobilization has led us to examine some other structurally related compounds together with a few other possible metal binding agents for their ability to remove excess metal from the organs, their subcellular fractions and blood cells of manganese administered rats and to investigate if there exists any relationship between the structure of such compounds and their metal mobilizing capacity. The present communication deals with the results of these investigations.

7597 Toxicity and accumulation of arsenic in green sunfish, Lepomis cyanellus, exposed to arsenate in water. Sorensen, E.M.B. (Univ. of Texas, Austin). *Bull. Environ. Contam. Toxicol.;* **15**: No. 6, 756-761(1976).

The purpose of the study was to determine to what extent green sunfish, an active freshwater fish, was affected by short-term exposures to high concentrations of a less potent arsenical, sodium arsenate. Acute or short-term effects of this arsenical were assessed on the basis of mortality; lethal time for 50 percent mortality (LT_{50}) and lethal dosage for 50 percent mortality (LD_{50}) were calculated by straight line graphic interpolation. Arsenic accumulation in whole fish at the time of death was measured using neutron activation analysis (NAA) and these values were compared with arsenic exposure, time before mortality, and fish condition. Cumulative percent mortality for all fish in the triplicate experiment increased with increasing exposure concentrations. Lethal times for 50 percent mortality for 100, 500, and 1000 ppM arsenic were 46, 17, and 12 hr, respectively. This effect was also observed at lower exposure levels: at 30 and 60 ppM arsenic and 20°C, LT_{50} decreased from 527 to 210 hr for green sunfish (SORENSEN 1974). Other metals produced the same effects. Time of death was compared to total arsenic accumulation. Fish exposed 10 100 ppM arsenic appear to be more successful in removing arsenic from the body over short periods of time. Arsenic retention in organs of L cyanellus appeared to be short in duration. The high and variable arsenic accumulation before mortality of fish exposed to 500 and 1000 ppM arsenic seems to indicate that mortality might be caused by a second mechanism (perhaps mucous-clogging of the gills due to metallic irritation) at these levels. A lack of a correlation between various specimen parameters and fish weight might be due, in part, to the fact that nonessential elements such as arsenic (LIEBSCHER and SMITH 1968) are merely contaminations of tissue and have no significant function.

MAN

REFER ALSO TO CITATION(S) 5884, 5971, 6431, 7139, 7392, 7424, 7485, 7513, 7585, 7588

7598 Leaching of cadmium from plastic toys. Flowles, G.W.A. (The Univ., Berkshire, Eng.). *Sci. Total Environ.;* **7**: No. 3, 207-216(May 1977).

A systematic examination has been made of the factors that influence the leaching of cadmium from solid ABS (acrylonitrile-butadiene-polystyrene) plastic toys containing cadmium sulfide or selenide pigments, and realistic test procedures have been developed that give reproducible results. It has been shown that in the absence of light less than 100 ppM of cadmium is extracted from the pigmented plastic used for toys on sale in the United Kingdom. The data show that a child would have to chew and swallow about a gram of the "worst" plastic toy to ingest around 50 μg of cadmium. However, in most instances, the use of cadmium-based pigments in toys is unnecessary and should be avoided, especially, since there is very little information on the chronic toxic effects of small amounts of cadmium.

7599 Water hardness and cardiovascular disease. Elements in water and human tissues. Sharrett, A.R. (National Institutes of Health, Bethesda, MD). *Sci. Total Environ.;* **7**: No. 3, 217-226(May 1977).

The hypothesis that the hardness of drinking water has a causal role in the development of cardiovascular disease will be strengthened if it can be demonstrated that elements in drinking water find their way into human tissues in significant amounts. For biologically important metals, the evidence is reviewed for a relationship of tissue levels to levels in drinking water. Hard water can contribute significantly to daily magnesium intake. Residents of hard-water areas may have raised levels of magnesium in coronary arteries, bone, and myocardial tissue. Lead levels in bone and in blood have been shown to be elevated in individuals living in homes with lead plumbing and soft water. Cadmium intake from water is probably small compared to that from other sources, and there is no convincing evidence of alteration in human tissue levels via drinking water cadmium. Human zinc and copper tissue levels are of interest

but have not been adequately studied in relation to drinking water levels.

7600 Clinical toxicology of mercury. Gerstner, H.B.; Huff, J.E. (Oak Ridge National Lab., TN). *J. Toxicol. Environ. Health;* **2**: No. 3, 491-526(Jan 1977).

Based on an extensive literature search, general principles of mercury toxicity are outlined with respect to human individuals and populations. For the metal itself, as well as for its most important inorganic and organic compounds, the review discusses behavior in the body, characteristic clinical pictures, assessment of threshold levels, and evaluation as potential environmental hazards. Particular emphasis is placed on those diagnostic signs and symptoms which furnish early warning signals, permitting detection and elimination of overexposures.

7601 Collagen breakdown and nitrogen dioxide inhalation. Hatton, D.V. (Lyndon B. Johnson Space Center, Houston, TX); Di Ferrante, N.; Leach, C.S.; Nicogossian, A.E.; Di Ferrante, N. *Arch. Environ. Health;* **32**: No. 1, 33-36(1977).

Measurements of urinary hydroxylysine glycosides indicate that considerable collagen degradation occurred during the reentry into the earth's atmosphere of the American astronauts of the Apollo-Soyuz mission. Since the crew accidentally inhaled nitrogen dioxide, a recognized pulmonary irritant, and showed clinical and roentgenographic signs of diffuse chemical pneumonitis, it is likely that collagen degradation occurred in the pulmonary parenchyma.

7602 Investigation of lead workers for subclinical effects of lead using three performance tests. Milburn, H.; Mitran, E.; Crockford, G.W. (London School of Hygiene and Tropical Medicine, Eng.). *Ann. Occup. Hyg.;* **19**: No. 3/4, 239-247(Dec 1976).

Using three performance tests, lead exposed workers were studied for signs of subclinical neurological effects. The three tests were: two flash fusion threshold, a test considered to indicate the level of arousal; reaction time to a touch stimulus and the rate at which hand grip pressure is developed, both influenced by the conduction velocity of the peripheral nerves and impulse transmission across the motor end plates. Sixteen male lead workers were tested and compared with a non-exposed matched control group of fifteen. The occupational history, neurological symptoms and blood lead levels were recorded. The three performance tests revealed no differences between the exposed and the non-exposed groups.

7603 Prevalence of occupational disease. Newhouse, M.L. (London School of Hygiene and Tropical Medicine, Eng.). *Ann. Occup. Hyg.;* **19**: No. 3/4, 285-292(Dec 1976).

When discussing the prevalence of occupational disease, both the prescribed diseases and the diseases where occupation has an important etiological component should be considered. Available statistics indicate that there has been a substantial improvement in the control of important prescribed diseases such as lead poisoning and pneumoconiosis. In the United Kingdom in 1900 there were 1000 cases of lead poisoning with 38 fatalities. This number decreased to 49 cases in 1956 when the number again increased due to a change from clinical diagnosis to diagnosis on biochemical evidence. The number of cases of coal workers' pneumoconiosis has declined since the 1950s but the number of coal miners has also been reduced by more than $^1/_3$. Industrial dermatitis is still a considerable problem. Vibration induced white fingers was mentioned as a disease with a very large occupational component but which for a variety of reasons is not prescribed for industrial injury benefit. Illnesses due to injuries to the back, to sciatica, disc disease or lumbago cause a very large amount of sickness and are often associated with heavy manual labor particularly if an awkward posture has to be adopted for the job. The average absence after a back injury in the London Docks was 61 days. Chronic bronchitis is the biggest single cause of sickness absence. Many studies have shown that the etiology is multifactorial but that hard physical work and a dusty environment in the work place are important adverse factors. Improved control of the working environment and methods of work may influence the development of chronic disease in the older worker.

7604 Particle size distribution and human respiratory deposition of trace metals in indoor work environments. Akselsson, K.R.; Desaedeleer, G.G.; Johansson, T.B.; Winchester, J.W. *Ann. Occup. Hyg.;* **19**: No. 3/4, 225-238(Dec 1976).

Respiratory response to inhalation of fine particles has been investigated for the aerosol generated by welding. Particles were sampled using a pair of 5-stage cascade impactors operating at 1 l/min flow rate. The subject exhaled into one impactor through an air ballast arrangement, and the other impactor simultaneously sampled the surrounding air. Particle size fractions were analyzed for principal elemental constituents from sulfur to lead using proton induced x-ray emission, PIXE. The results indicated a complex respiratory response, including both increase in particle size due to exposure to high humidity in the respiratory tract and deposition of particles during inhalation. The response was found to be different for the element group Mn, Cr, Fe, Ni compared to the group K, Ca, Ti by observing the associations among the elements as a function of particle size in the inhaled and exhaled aerosol. However, for respiratory deposition efficiency alone in all runs averaged together, no systematic differences between the different elements are demonstrated at the 99% confidence level.

7605 Relationship between lead concentration in blood and biological response for porphyrin metabolism in workers occupationally exposed to lead. Tomokuni, K.; Ogata, M. (Okayama Univ. Medical School, Japan). *Arch. Toxikol.;* **35**: No. 4, 239-246(1976).

The biological responses of the heme biosynthesis pathway in male workers moderately exposed to lead are discussed in relation to the concentration of lead in the blood. The level of erythrocyte delta-aminolevulinic acid dehydratase (ALA-D) activity in the group of lead-exposed workers was remarkably reduced while the level of erythrocyte protoporphyrin (Proto) in them was strikingly increased, compared to normal levels. On the other hand, the amounts of hemoglobin (Hb) and urinary delta-aminolevulinic acid (ALA) in the group of lead-exposed workers kept the normal levels. In the workers moderately exposed to lead, the log of erythrocyte Proto level was closely correlated to the blood lead level and the sensitivity of the Proto test was almost equal to that of erythrocyte ALA-D test. It was observed that the erythrocyte Proto was remarkably increased even in lead-exposed workers whose ALA excretion into the urine was in the range of normal level.

OTHER ENVIRONMENTAL POLLUTANT EFFECTS

REFER ALSO TO CITATION(S) 6432, 6445

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 7598

GEOSCIENCES

REFER ALSO TO CITATION(S) 5889

GEOLOGY AND HYDROLOGY

REFER ALSO TO CITATION(S) 5851, 5891, 5892, 5893

7606 Problem of salt accumulation. Sokholin, Kh.G. pp 110-120 of In Novye napravleniya poiska mestorozhdenii nefti i gaza. Krylov, N.A. (ed.). Moscow; Izdatel'stvo Nauka (1976). (In Russian)

A look is taken at the most important geological events which took place in the permian era which is an outstanding period of salt accumulation in the history of the earth. Data are presented on stratified deposits of copper, lead and zinc which are known to be constant congeners of evaporated solutions, and can throw additional light on their formation. Particular attention is devoted to rift zones, and in particular to the Red Sea, which is a classical region of core expansion and on the bottom of which a high-temperature ore-salt solution is found. Contemporary opinions on processes of volcanogenic-sedimentary formation of metal ores were studied. On the basis of a combined analysis of all these data it is concluded that thick accumulations of salt deposits are sedimentary according to the method of formation, but endogenic according to the source of entry of the initial components into the ocean basins. 31 refs. (SJR)

GEOPHYSICS

SEISMOLOGY AND TECTONICS

REFER ALSO TO CITATION(S) 5893

GEOPHYSICAL SURVEY METHODS

REFER ALSO TO CITATION(S) 5852

7607 Weighted vertical stacking in crustal seismic reflection studies on the Canadian shield. Brown, R.J. (Univ. of Lulea, Sweden); Friesen, G.H.; Hall, D.H.; Stephenson, O.G. *Geophys. Prospect.;* **25**: No. 2, 251-268(Jun 1977).

Seismic reflection methods are being developed at the University of Manitoba to aid in determining fine crustal structures in the Precambrian of Manitoba and northwestern Ontario. Present-day

environmental concern as well as mineshaft conditions necessitate the detonation of several smaller charges repeated, say, I times and followed by "vertical" stacking. To obtain the familiar $\sqrt{I}$ improvement in signal-to-noise (S : N) amplitude ratio applying the straight-sum (SS) method, one assumes, among other things, that both S : N ratio and signal variance are the same on all traces. Dropping these assumptions, as we must for our data, it becomes necessary to apply weighting coefficients to optimize the S : N ratio of the stacked trace. We still assume the signal shapes to be the same for repeated shots, so for the jth trace on the record of the ith shot we model the time series as: t/sub ij/ = a/sub i/(s/sub j/ + n/sub ij/); where a/sub i/ is a scaling factor. The proper weights w/sub i/ are then shown to be proportional to sigma/sub si//sigma²/sub ni/ where sigma² is variance, or to γ/sub i//a/sub i/ where γ/sub i/ is S : N power ratio. Applying the weighted-stack (WS) method gives S : N amplitude ratios which are, on average, 55% of the optimal ratios expected from WS theory compared with only 24% for the SS method. The 45% shortfall in WS performance is ascribed mainly to trace-alignment (or time-delay) errors. Varying noise levels on individual traces, slight dissimilarity of signal shape, and correlated noise may also contribute to a lesser extent (in decreasing order of significance). This WS method appears to strike a good practical balance between S : N improvement and processing efficiency.

7608 Digitalization of magnetotelluric signals: description of the equipment. Iliceto, V. (Univ., Padua, Italy). *Geophys. Prospect.;* **25**: No. 2, 292-301(Jun 1977). (In Italian).

A magnetotelluric digital equipment has been designed and built for operation in geophysical and applied geophysical and applied geophysical research. The five components of the natural electromagnetic field can be digitized in the frequency range $^{1}/_{1000}$ Hz (magnetic sensor's response limits) to some tens Hz. The magnetotelluric (MT) data are directly digitized in the field and stored in a cassette tape recorder.

7609 Characteristics of audio and sub-audio telluric signals. Telford, W.M. (McGill Univ., Montreal). *Geophys. Prospect.;* **25**: No. 2, 321-333(Jun 1977).

Telluric current measurements in the audio and sub-audio frequency range, made in various parts of Canada and South America over the past four years, indicate that the signal amplitude is relatively uniform over 6 to 8 midday hours (LMT) except in Chile and that the signal anisotropy is reasonably constant in azimuth.

7610 Adaptive predictive deconvolution of seismic data. Wang, R.J. (Amoco Production Co., Tulsa, OK). *Geophys. Prospect.;* **25**: No. 2, 342-381(Jun 1977).

The Wiener prediction filter has been an effective tool for accomplishing dereverberation when the input data are stationary. For non-stationary data, however, the performance of the Wiener filter is often unsatisfactory. This is not surprising since it is derived under the stationarity assumption. Dereverberation of nonstationary seismic data is here accomplished with a difference equation model having time-varying coefficients. These time-varying coefficients are in turn expanded in terms of orthogonal functions. The kernels of these orthogonal functions are then determined according to the adaptive algorithm of Nagumo and Noda. It is demonstrated that the present adaptive predictive deconvolution method, which combines the time-varying difference equation model with the adaptive method of Nagumo and Noda, is a powerful tool for removing both the long- and short-period reverberations. Several examples using both synthetic and field data illustrate the application of adaptive predictive deconvolution. The results of applying the Wiener prediction filter and the adaptive predictive deconvolution on nonstationary data indicate that the adaptive method is much more effective in removing multiples. Furthermore, the criteria for selecting various input parameters are discussed. It has been found that the output trace from the adaptive predictive deconvolution is rather sensitive to some input parameters, and that the prediction distance is by far the most influential parameter.

MINERALOGY, PETROLOGY, AND ROCK MECHANICS

7611 (UCRL—79948) **Mineralogical studies on the diamondiferous kimberlite of the Wajrakharur area, southern India.** Akella, J.; McCallister, R.H.; Meyer, H.O.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Sep 1977. Contract W-7405-ENG-48. 21p. (CONF-771047—1). Dep. NTIS, PC A02/MF A01.

From 2. international kimberlite conference; Santa Fe, New Mexico, USA (3 Oct 1977).

Diamond-bearing kimberlites occur in Andhra Pradesh at Wajrakharur and Lattavaram. In general the kimberlites at the surface are elliptical with their longer axes trending approximately N70°E. The pipes have intruded P epsilon Dharwarschists, granites, and gneisses but have very limited surface exposure. The kimberlite near Lattavaram is hard and compact, but slight differences in mineralogy are obvious between the two pipes at this locality. One kimberlite pipe consists predominantly of phenocrysts of olivine (Fo_{92}) in a medium to fine grained groundmass of magnetite-rich spinel, chromite, phlogopite and monticellite. Pectolite is also present. However, a remarkable feature of this kimberlite is the ubiquitous occurrence of needle-like crystals of nickel sulfide in the serpentine. The second kimberlite at Lattavaram also is predominantly of serpentinized olivine, picroilmenite and minor garnet in a matrix of calcite, phlogopite, and opaque phases including Cr-rich ilmenite. Minor phases such as sphene and perovskite are also present. Olivine ranges between Fo_{88} to Fo_{92}; and garnet is about 75 percent pyrope, 11 percent grossular with between 2.5 to 3 wt. percent Cr_2O_3. Up to the present time mantle xenoliths have not been found, but crustal xenoliths (e.g., amphibolites) are not uncommon.

7612 Change in the electric fields in spontaneously heating heaps of solid combustible minerals. Obukhov, N.K.; Aleksandrov, I.V.; Burkov, P.A. (Sci-Res and Des Inst of the Min of Useful Miner by the Open-Cast Method). *Solid Fuel Chem.* [8]*USSR*[9] [8]*Engl. Transl.*[9]; **10**: No. 4, 65-69(1976).

An increase in the electric fields in self-heating heaps of solid combustible minerals has been established experimentally. A theoretical explanation of the observed phenomenon is given on the basis of electrochemical theories of corrosion and of fuel cells. 5 refs.

GEOCHEMISTRY

REFER ALSO TO CITATION(S) 6069

7613 Geochemical exploration methods for mineral deposits. Beus, A.A.; Grigorian, S.V. Wilmette, IL; Applied Publishing Ltd. (1977). 295p. .

Translated from Russian.

The material presented herein stresses material related to geochemistry that is new in textbook form to Soviet geochemists and new in any form to English-speaking geochemists. The material is divided into 11 chapters, and the first two chapters discuss up-to-date material on the chemical composition of the earth's crust, the major laws of the distribution of the chemical elements in rocks, and the main concepts which characterize the geochemical migration of the elements. General concepts used in applied geochemistry are covered in Chapter 3. Chapter 4 deals with the use of geochemical specialization of rocks in geochemical exploration. Chapters 5,6,7,8 and 9 explore application of various mineralogical characteristics to prospecting and are entitled: Primary Geochemical Halos of Mineral Deposits: Their Use in Prospecting; Secondary (Supergene) Lithogeochemical Halos and Dispersion Trains from Mineral Deposits; Hydrogeochemical Halos from Mineral Deposits; Biogeochemical Halos from Mineral Deposits and their Use in Exploration; and Atmochemical Halos from Mineral Deposits. Chapters 10 and 11 are entitled: The Application of Geochemical Methods Depending on the Scope and Objectives of Exploration and Methods of Mathematical Statistics Used in Geochemical Exploration. A glossary and an extensive bibliography are included. (BLM)

7614 (USGS—1005, pp 116-122) **Lithium abundances in oil field waters.** Collins, A.G. (Energy Research and Development Administration, Bartlesville, OK). 1976.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

In Lithium resources and requirements by the year 2000.

The abundance of lithium in oilfield waters was surveyed because of its potential use in energy production. Waters from several locations were found to contain about 500 mg/l of lithium and one approached 700 mg/l. It is postulated that the high lithium concentrations in some waters in the Jurassic Smackover Formation originated from lithium-enriched continental waters.

OCEANOGRAPHY

REFER ALSO TO CITATION(S) 7336

7615 (BNL—23199) **Towards a management perspective for coastal upwelling ecosystems.** Howe, S.O.; Walsh, J.J. (Brookhaven National Lab., Upton, N.Y. (USA)). 1976. Contract EY-76-C-02-0016. 39p. (CONF-7606122—2). Dep. NTIS, PC A03/MF A01.

From 27. annual AIBS meeting; New Orleans, Louisiana, United States of America (USA) (Jun 1976).

Data are reviewed from studies on the general distribution of upwelling of coastal waters, associated current patterns, and first order biological effects. Field observations and theory are discussed. Recent research has shown that variability and dynamism are the predominant characteristic features of these regions. Populations

related by nonlinear interactions occur in constantly moving patches and swirls subjected to variability in the winds, currents, water chemistry, and solar insolation. Gross stationary features of upwelling communities have been described, but the responses of critical components and their relationships to human or natural perturbations remain poorly defined in this and other types of coastal ecosystems. Large scale research programs recognize that the continental shelf ecosystems are complex event-oriented phenomena. It is postulated that assessment of living resources in an environmental vacuum may lead to mismanagement and hindcasting rather than prescient management. A growing data base encourages the development of computer simulation models of ecosystem relationships and responses will lead to better understanding and management of these and other marine ecosystems in the future. 80 references.

7616 (COO—2689-8) **Paleomagnetic stratigraphy of North Pacific giant piston core LL44-GPC3 (30° 20′N, 157° 50′W; MPG-I study area).** Prince, R.A.; Heath, G.R. (Rhode Island Univ., Kingston (USA). Graduate School of Oceanography). Jul 1977. Contract EY-76-S-02-2689. 29p. Dep. NTIS, PC A03/MF A01.

Stable detrital remanent magnetization in North Pacific core GPC-3 (30° 19.9′ N, 157° 49.9′ W) allows the upper 4.5 m to be dated by correlation with the standard geomagnetic time scale. The sedimentation rate for this interval decreases from 2.5 mm/1000 yr. at the surface to 1.1 mm/1000 yr. at 2 m.y. Older sediments lack the consistently stable DRM required for similar dating, but stable DRM paleoinclination measurements at 2250 cm suggest deposition at a paleolatitude between 7.6 and 13.1° N. Based on current reconstructions of the absolute drift of the crust of the Pacific, this implies an age of deposition of 61 to 71 m.y. Such a range is consistent with P. Doyle's biostratigraphic estimates based on ichthyolith assemblages. Sedimentation at GPC-3 appears to have been continuous for the past 70 million years, with the rate increasing from less than 0.3 m/my at the base to 2.5 m/my at the sea floor.

7617 (NP—22650) **International decade of ocean exploration. Progress report, Volume 6, April 1976—April 1977.** (Department of Commerce, Washington, D.C. (USA); National Oceanic and Atmospheric Administration, Washington, D.C. (USA)). Oct 1976. 75p. NTIS.

The International Decade of Ocean Exploration (IDOE) is a long-term, international, cooperative program to improve the use of the ocean and its resources for the benefit of mankind. This report provides the scientific community and other interested persons with information, data inventories, and lists of scientific reports derived from U.S. IDOE projects. The text is arranged according to the program areas established for IDOE. Details of subprograms are given under appropriate programs. Currently funded projects are listed. Bibliographies follow subprogram text.

PHYSICS RESEARCH

ASTROPHYSICS AND COSMOLOGY

7618 **Observatory reports, Lawrence Livermore Laboratory, University of California, Livermore.** Tarter, C.B. (Univ. of California, Livermore). *Am. Astron. Soc., Bull.;* **9**: No. 1, 137-139(1977).

Research on astrophysics is summarized including planetary and stellar structure, supernovae and nucleosynthesis, nebulae and the interstellar medium, and high energy astrophysics. Also described are equations of state and opacities and plasma spectroscopy. (JFP)

COSMIC RADIATION

7619 **Cosmic and atmospheric gamma-rays from 3 to 15 MeV.** Koga, R. Riverside, CA; Univ. of California (1974). 253p. University Microfilms Order No. 77-14,397.

Thesis (Ph. D.).

Gamma-rays in the energy interval of 3 to 15 MeV at the downward direction of 14 to 28° to the zenith were measured from a balloon flight at Palestine, Texas, 40° North geomagnetic latitude, on May 14, 1972. Gamma-ray fluxes at downward directions of 14 to 28° to the zenith, 4 g/cm^2 of residual atmosphere, energies of 3 to 4, 4 to 6, 5 to 7, 7 to 10 and 10 to 15 MeV were 7.5 +- 0.6, 4.6 +- 0.5, 2.6 +- 0.5, 1.00 +- 0.15 and 0.70 +- 0.15 x 10^{-3} γ/cm^2-sec-ster-MeV, respectively. Extrapolation of the atmospheric secondary photon fluxes measured by other groups to 3.5, 4.5, 6.0, 8.5, and 12.5 MeV were subtracted from the total atmospheric photon fluxes. However, the differences could not be taken as the diffuse gamma-ray fluxes, since the values involved large uncertainties. The upper limits of the fluxes from the Crab Nebula, M87, and the quiet sun were obtained. Pulsed gamma-ray observation from NP0532 was attempted using the period of the pulsation. A burst at 20:13 UT on May 14, 1972, was observed. The duration of the burst was 4 min and the increase of the count rate was 59sigma.

QUASI-STELLAR, RADIO, AND X-RAY SOURCES

REFER ALSO TO CITATION(S) 7619

COSMOLOGY

7620 (ORO—3992-303) **Hot hadronic matter in the early universe.** Bowers, R.L.; Dykema, P.G.; Gleeson, A.M. (Texas Univ., Austin (USA). Center for Particle Theory). Apr 1977. Contract EY-76-S-05-3992. 43p. Dep. NTIS, PC A03/MF A01.

A fully relativistic equation of state for hot baryonic matter was used to investigate the strong interaction contribution to the equation of motion of the Friedmann universe. A pronounced softening of the equation of state is observed near nuclear density. The significance of the results is analyzed in terms of analytic solutions for the Friedmann cosmology.

PLANETARY PHENOMENA

7621 (LA-UR—77-368) **Global seismic effects of basin-forming impacts.** Hughes, H.G.; App, F.N.; McGetchin, T.R. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 43p. (CONF-761165—1). Dep. NTIS $4.00.

From Conference on comparisons of mercury and the moon; Houston, Texas, United States of America (USA) (Nov 1976).

Models of the thermal evolution of the moon and the terrestrial planets suggest that basin-forming impacts occurred when the planets had partially molten interiors overlain by thickening lithospheres, comparable in thickness to the basin radii. The effects of large impacts on planetary surfaces were investigated using a Lagrangian computer program which treats shock wave propagation and includes the effects of material strength, elastic-plastic behavior and material failure. The computer code and some physical details of the numerical techniques are described, and the results of several initial calculations are reported. The global seismic effects for cratering energies (10^{24} and 10^{28} J) intermediate between the Copernicus and Imbrium events on the moon, are studied and the phenomenologies for assumed solid and molten planetary interiors are compared. The principal results are as follows: (1) Far-field effects are largely independent of cratering mechanisms (e.g., simulated impact vs buried explosion). (2) Antipodal seismic effects are significantly enhanced by focusing and are of substantial magnitude. Vertical ground motion may be on the order of kilometers, and accelerations approach one lunar-g. (3) The most violent activity occurs at significant depth beneath the antipode, considerably after the passage of the initial compressive/rarefactive shock wave, and results from complex interactions with the free surface. (4) Seismic effects are decidedly more pronounced for a molten planet than for a solid one. (5) Tensile failure may occur at depths of tens of kilometers beneath the antipode, and may also occur over the entire surface, although at shallower depths.

ATOMIC, MOLECULAR, AND CHEMICAL PHYSICS

BEAMS AND THEIR REACTIONS

REFER ALSO TO CITATION(S) 7090

7622 (LBL—6837) **Experimental measurements of negative hydrogen ion production from surfaces.** Graham, W.G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1977. Contract W-7405-ENG-48. 8p. (CONF-770940—9). Dep. NTIS, PC A02/MF A01.

From Symposium on the production and neutralization of negative hydrogen ions and beams; Upton, New York, USA (26 Sep 1977).

Experimental measurements of the production of H^- from surfaces bombarded with hydrogen are reviewed. Some measurements of H^+ and H^0 production from surfaces are also discussed with particular emphasis on work which might be relevant to ion source applications.

7623 (LBL—6839) **D- production by backscattering from clean alkali-metal surfaces.** Schneider, P.J.; Berkner, K.H.; Graham, W.G.; Pyle, K.V.; Stearns, J.W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1977. Contract W-7405-ENG-48. 9p. (CONF-770940—8). Dep. NTIS, PC A02/MF A01.

From Symposium on the production and neutralization of negative hydrogen ions and beams; Upton, New York, USA (26 Sep 1977).

Measurements have been made of the total back-scattered D^- yields from Cs, Rb, K, Na and Li surfaces bombarded with D_2^+ and

D_3^+ in the energy range 0.05 to 3.5 keV/nucleon. All measurements were made at a background pressure less than 10^{-9} Torr and the alkali-metal surfaces were evaporated onto a substrate in situ to assure uncontaminated surfaces. For each target, the D^- yield is at a maximum (as high as 12% per incident deuteron for Cs) between 150 and 300 eV/nucleon, and at any measured energy, the D^- yield decreases from Cs to Li in the order given above.

7624 (LBL—6900) **Correlation effects in photoelectron spectrometry of atoms.** Shirley, D.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1977. Contract W-7405-ENG-48. 30p. (CONF-770935—3). Dep. NTIS, PC A03/MF A01.

From 5. international conference on vacuum ultraviolet radiation physics; Montpellier, France (5 Sep 1977).

A survey of the effects that can be studied using photoelectron spectrometry is presented, and examples are cited to illustrate the current state of knowledge in this area. 32 refs.

7625 (UCRL—79311) **Role of space charge in beam transport.** Osher, J.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Mar 1977. Contract W-7405-ENG-48. 14p. (CONF-770949—1). Dep. NTIS, PC A02/MF A01.

From International conference on low energy ion beams; Salford, UK (5 Sep 1977).

Space charge as it affects ion beam transport is reviewed. The approach here will be to derive beam-current criteria for divergence from space charge, review recent theoretical models for fractional space-charge neutralization, discuss space-charge-related observations on ion-beam transport in a specific experimental system, and briefly note several applications using space charge. Experimental measurements of effective space charge are discussed for a dc ion-source test stand using a 90^0 double-focusing magnet for species separation and for a solenoidal lens magnet for trim focus of the ion beam preparatory to entrance into a 400-kV accelerator column.

7626 (UCRL—79927) **Efficient production of neutral beams by photodetachment of negative ions.** Fink, J.H.; Hamilton, G.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Aug 1977. Contract W-7405-ENG-48. 7p. (CONF-770940—1). Dep. NTIS, PC A02/MF A01.

From Symposium on the production and neutralization of negative hydrogen ions and beams; Upton, New York, USA (26 Sep 1977).

A neutral fraction approaching 97 percent can be attained by photodetachment of negative ions if the photon density and thickness are adequate. This high efficiency of neutralization is desirable not only because of the improvement in power balance and power efficiency but also because of the increase in the useable beam current per module. Only modest improvements in commercial solid-state lasers are required to fulfill the requirements of a photodetachment cell for a fusion reactor. The wavelength of 0.85×10^{-4} cm is suitable with respect to the photodetachment cross section, the performance characteristics of present-day lasers, and the high reflectivity of the mirrors required for the optical cavity. Improvements may be possible by using resonances in the near ultraviolet region to enhance the photodetachment cross section. Three reactor-design studies were conducted and it was found that the required laser power is only economical for large injection systems in which beams of several hundred amperes are passed through a single optical cavity for photodetachment. The method is not economical for smaller systems.

ATOMIC AND MOLECULAR PROPERTIES

7627 (CONF-770653—(Absts.)) **Abstracts from the international conference on multiphoton processes.** (Rochester Univ., N.Y. (USA)). 1977. Contract EY-76-C-02-4117. 263p. Dep. NTIS, PC A12/MF A01.

From International conference on multiphoton processes; Rochester, New York, United States of America (USA) (6 Jun 1977).

Abstracts were presented for a conference on multiphoton processes. Included are collision and collisionless phenomena, and quantum electrodynamics. (JFP)

7628 (UCRL—79470) **Multiphoton spectroscopy in heavy elements.** Solarz, R.W.; Paisner, J.A.; Worden, E.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 May 1977. Contract W-7405-ENG-48. 12p. (CONF-770653—1; IS—77-123). Dep. NTIS, PC A02/MF A01.

From International conference on multiphoton processes; Rochester, New York, United States of America (USA) (6 Jun 1977).

Some recently discovered regularities in the spectra of heavy elements which are also applicable to the analysis of the spectra of lighter atoms are described. It is pointed out that stepwise resonant multiphoton methods are irreplaceable tools in the study of high lying states in a complex atomic system. Systematic applications of these methods has permitted regularities to be observed which also hold for the lighter elements. It is noted that greatly increased understanding of the excited state structure of heavy atoms is not possible. 8 references. (JFP)

POSITRONIUM, MUONIUM, AND MUONIC AND MESIC ATOMS AND MOLECULES

REFER ALSO TO CITATION(S) 7177

COLLISION PHENOMENA

REFER ALSO TO CITATION(S) 7627, 7732

7629 (LBL—6838) **D- production by multiple charge-transfer collisions in metal-vapor targets.** Schlachter, A.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1977. Contract W-7405-ENG-48. 15p. (CONF-770940—7). Dep. NTIS, PC A02/MF A01.

From Symposium on the production and neutralization of negative hydrogen ions and beams; Upton, New York, USA (26 Sep 1977).

A beam of D^- ions can be produced by multiple charge-transfer collisions of a D^+ beam in a thick metal-vapor target. Cross sections and equilibrium charge-state fractions are presented and discussed.

7630 **Molecular electronic structure theory: 1972—1975.** Schaefer, H.F. III. (Univ. of California, Berkeley). *Annu. Rev. Phys. Chem.;* **27**: 261-290(1976).

In this review of molecular electronic structure theory the emphasis is placed on the most important and innovative contributions. The Hartree-Fock and correlation problems as well as applications of the theory are treated. 269 references. (JFP)

ATOMIC AND MOLECULAR THEORY

REFER ALSO TO CITATION(S) 7627

GENERAL FLUID DYNAMICS

7631 (NUREG—0261) **Natural convection in horizontal fluid layers.** Suo-Antilla, A.J. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Feb 1977. 154p. NTIS $6.75.

Thesis.

The experimental work includes developing and using a thermal convection cell to obtain measurements of the heat flux and turbulent core temperature of a horizontal layer of fluid heated internally and subject to both stabilizing and destabilizing temperature differences. The ranges of Rayleigh numbers tested were 10^7 equal to or less than R/sub I/ equal to or less than 10^{13} and -10^{10} equal to or less than R/sub E/ equal to or less than 10^{10}. Power integral methods were found to be adequate for interpolating and extrapolating the data. The theoretical work consists of the derivation, solution and use of the mean field equations for study of thermally driven convection in horizontal layers of infinite extent. The equations were derived by a separation of variables technique where the horizontal directions were described by periodic structures and the vertical being some function of z. The derivation resulted in a coupled set of momentum and energy equations. The equations were simplified by using the infinite Prandtl number limit and neglecting direct intermodal interaction. Solutions to these equations are used to predict the existence of multi-wavenumber flows at all supercritical Rayleigh numbers. Subsequent inspection of existing experimental photographs of convecting fluids confirms their existence. The onset of time dependence is found to coincide with the onset of the second convective mode. Each mode is found to consist of two wavenumbers and typically the velocity and temperature fields of the right modal branch are found to be out of phase.

PROPERTIES AND STRUCTURE OF FLUIDS

REFER ALSO TO CITATION(S) 7708

MAGNETOHYDRODYNAMICS

REFER ALSO TO CITATION(S) 7750

PARTICLE INTERACTIONS AND PROPERTIES - EXPERIMENTAL

REFER ALSO TO CITATION(S) 7638

7632 (COO—1428-440) **Renewal proposal for research on nucleon structure and sub-nucleonic components. Progress report, June 1, 1977—January 31, 1978.** Fowler, E.C. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Physics). 17 Mar 1977. Contract EY-76-C-02-1428. 23p. Dep. NTIS, PC A02/MF A01.

Experimental research in high energy physics is summarized. (JFP)

7633 (COO—3539-8) **Experimental investigations in particle physics at intermediate energies. Progress report, December 1, 1976—November 30, 1977.** Auerbach, L.B.; Highland, V.L.; McFarlane, W.K. (Temple Univ., Philadelphia, Pa. (USA). Dept. of Physics). Aug 1977. Contract EY-76-S-02-3539. 6p. Dep. NTIS, PC A02/MF A01.

During this period there were completed, in collaboration with the University of New Mexico, data taking on single pion production in pp collisions at 800 MeV and on an exploratory experiment to measure n-n elastic cross sections at 800 MeV. The experiments, along with np elastic scattering data are currently being analyzed, and a preliminary account of the np elastic scattering data was presented at the Vancouver Nucleon-Nucleon conference. It is expected to complete data-taking on proton-antiproton annihilations to neutral vees at BNL, working with Rutgers and BNL. One will also set up and take data (in August) on the experiment to search for the three gamma decay mode of the neutral pion, at LAMPF.

ELECTROMAGNETIC INTERACTIONS

REFER ALSO TO CITATION(S) 7650

7634 (BNL—23233) **Review of experimental works on transition radiation.** Yuan, L.C.L. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 27p. (CONF-770596—2). Dep. NTIS, PC A02/MF A01.

From International symposium on transition radiation of high energy particles; Yerevan, Armenia, USSR (12 May 1977).

A brief review is given of some of the significant experimental achievements on transition radiation during the past years and also a review of some of the more recent developments on the transition radiation detector are given which are believed to be of great importance.

7635 (UCSB-GEN-10-PA23—31) **High energy user group at Santa Barbara. Progress report, May 1976—March 1977.** Caldwell, D.O. (California Univ., Santa Barbara (USA)). 1977. Contract EY-76-C-03-0010-023. 13p. Dep. NTIS, PC A02/MF A01.

Experimental research on electromagnetic interactions is summarized. A list of publications is included. (JFP)

7636 **Status of the evidence for a magnetic monopole.** Price, P.B. (Univ. of California, Berkeley). pp 167-214 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

The status of the experimental evidence for the existence of a magnetic monopole is discussed by describing the observations and data analysis. It is noted that while the considered event cannot be proven to have been produced by a monopole, if it can be shown at a high confidence level not to have been produced by any nucleus then future experiments of expanded scope are justified. 37 references. (JFP)

7637 **Recent results from SPEAR.** Tanenbaum, W. (Stanford Linear Accelerator Center, CA). pp 113-132 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

New e^+e^- colliding beam results are discussed including the total cross section in the 4 GeV region, exclusive multipion channels, Psi^- decays, and upper limits on high mass resonances. Nine references. (JFP)

WEAK INTERACTIONS

7638 (COO—2232A-49) **Finish: summary and conclusion.** Goulianos, K. (Rockefeller Univ., New York (USA)). 1977. Contract EY-76-C-02-2252. 7p. (CONF-770319—3). Dep. NTIS, PC A02/MF A01.

From 12. Rencontre de Moriond; Haute-Savoie, France (6 Mar 1977).

Experimental results presented at the Leptonic Interactions session of the XIIth RENCONTRE DE MORIOND are reviewed, with emphasis on how they relate to the question of the existence of charm and heavy leptons.

7639 (ORO—3992-308) **Cosmological upper bound on heavy neutrino lifetimes.** Dicus, D.A.; Kolb, E.W.; Teplitz, V.L. (Texas Univ., Austin (USA). Center for Particle Theory). May 1977. Contract EY-76-S-05-3992. 11p. Dep. NTIS, PC A02/MF A01.

An upper bound on the lifetime of a massive, neutral, weakly interacting lepton, nu/sub H/, is derived from standard big bang cosmology. Saturation of the bound and reasonable assumptions about the weak interaction of the nu/sub H/ then yield a prediction of approximately 10 MeV for its mass.

7640 **Preliminary neutral current results from Caltech-Fermilab.** Sciulli, F. (California Inst. of Tech., Pasadena). pp 133-139 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

Neutral current data from neutrino and antineutrino interactions is analyzed and preliminary results reported. The neutral current couplings are discussed. (JFp)

7641 **New vistas in neutrino physics.** Mann, A.K. (Univ. of Pennsylvania, Philadelphia). pp 171-198 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

Recent data on the high-y anomaly in inelastic antinu/sub μ/-nucleon scattering and on the ratio of cross sections σ/sub c//sup antinu//σ/sub c//sup nu/ are presented and interpreted in terms of new hadron production. The reactions of interest are nu/sub μ/ + nucleon $\rightarrow \mu^-$ + H and antinu/sub μ/ + nucleon $\rightarrow \mu^+$ + H, where H is any assembly of hadrons.

STRONG BARYON-INDUCED INTERACTIONS

REFER ALSO TO CITATION(S) 7685

7642 (ANL-HEP-CP—77-57) **Inelasticity and structure in pp $\rightarrow$ pp at medium energies.** Thomas, G.H. (Argonne National Lab., Ill. (USA)). Aug 1977. Contract W-31-109-ENG-38. 25p. (CONF-770674—7). Dep. NTIS, PC A02/MF A01.

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Above the inelastic threshold in pp scattering, the partial wave amplitudes get important inelastic contributions. This may lead to observable structure in pp spin measurements. One reviews some of the new pure spin total cross section data, and discuss the possible implications. It is suggested that a systematic study of the medium energy region might clarify some of the issues raised by the new data, in particular that of the existence of dibaryon resonances. Elastic and inelastic polarized pp measurements at ZGS energies are also reviewed as they may provide a clue about which medium energy measurements should be done.

7643 (ANL-HEP-PR-CP—77-47) **Asymmetry measurements in nucleon—nucleon scattering with polarized beams and targets at ZGS to Fermilab energies.** Yakosawa, A. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 29p. (CONF-770674—4). Dep. NTIS, PC A03/MF A01.

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Results of various asymmetry measurements in nucleon-nucleon scattering with polarized beams and targets at ZGS energies are presented. A possible direct-channel resonance in the pp system is discussed. Most of the discussion above ZGS energies are aimed at future measurements.

7644 (COO—2009-128) **Preliminary polarization results at Fermilab energies.** Corcoran, M.D.; Ems, S.E.; Fredericksen, F.; Gray, S.W.; Martin, B.; Neal, H.A.; Ogren, H.O.; Rust, D.R.; Sauer, J.R.; Smith, P. (Indiana Univ., Bloomington (USA). Dept. of Physics). 1977. Contract EY-76-S-02-2009. 21p. (CONF-770124—5). Dep. NTIS, PC A02/MF A01.

From Conference of the Orbis Scientiae Center for Theoretical Studies; Coral Gables, Florida, United States of America (USA) (16 Jan 1977).

The jet target, the superconducting spectrometer, and the polarimeter used to measure the recoil proton polarization in an Indiana University experiment at the Fermi National Accelerator Laboratory are described. Analysis procedures and data checks are explained, and preliminary results are presented and compared with model predictions. The future plans for the experiment are also discussed.

7645 (COO—2009-129) **Preliminary measurements of proton polarization in high energy inclusive processes.** Corcoran, M.D.; Ems, S.E.; Gray, S.W.;Martin, B.A.; Neal, H.A.; Ogren, H.O.; Rolvado, R.O.; Rust, D.R.; Sauer, J.R.; Smith, P. (Indiana Univ., Bloomington (USA). Dept. of Physics). 1977. Contract EY-76-S-02-2009. 18p. (CONF-770217—3). Dep. NTIS, PC A02/MF A01.

From Annual meeting of the American Physical Society; Chicago, Illinois, United States of America (USA) (7 Feb 1977).

A preliminary measurement of inclusive proton polarization at P/sub T/ = 1.1 GeV/c and x = 0.89 was completed at the internal target area of Fermilab. Measurements were made at 100, 200, 300, and 400 GeV beam energies using a carbon target.

7646 (LA-UR—77-1938) **nD scattering at 180° for neutron energies from 200 to 800 MeV.** Bonner, B.E.; Hollas, C.L.; Newsom, C.R.; Riley, P.J.; Glass, G. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 6p. (CONF-770674—6). Dep. NTIS, PC A02/MF A01.

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

In the expectation that information on the high momentum components of the deuteron wave function can be obtained from the scattering of hadrons of modest energy, the 180° excitation function is reported which was measured in nd elastic scattering for incident energies of 200 to 800 MeV. Differential cross sections are plotted. However, only a small fraction of the data are analyzed thus far. 17 references. (JFP)

7647 (ORO—4449-22) **Study of the neutron—proton interaction in the 300—700 MeV energy region. Annual progress report, 1976—1977.** Northcliffe, L.C. (Texas Agricultural and Mechanical Univ., College Station (USA). Research Foundation). 1977. Contract EY-76-S-05-4449. 10p. Dep. NTIS, PC A02/MF A01.

Studies of the differential cross section for charge-exchange scattering, meson production in nucleon—nucleon collisions, and the momentum spectra and angular distributions of charged particles produced in bombardment of various targets by neutrons are summarized. A list of publications is given. (JFP)

STRONG MESON-INDUCED INTERACTIONS

REFER ALSO TO CITATION(S) 7641, 7685

7648 (ANL-HEP-CP—77-37) **K anti K amplitude analyses.** Cohen, D. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 22p. (CONF-770406—2). Dep. NTIS, PC A02/MF A01.

From 5. international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (29 Apr 1977).

A review is presented of amplitude analyses of the K anti K system produced in reactions of the type π/sup +-/N → K anti KN. These analyses establish the existence of a new S-wave K anti K state at a mass of approximately 1300 MeV, having isospin 0 and a slow phase variation.

7649 (COO—1428-443) **Inclusive charged pion production in π^{+-}p interactions.** Barnes, V.E. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Physics). 1977. Contract EY-76-C-02-1428. 24p. (CONF-770697—1). Dep. NTIS, PC A02/MF A01.

From 8. international symposium on multi-particle dynamics; Kaysersberg, France (12 Jun 1977).

Inclusive single particle spectra are reviewed for π/sup +-/ production from π/sup +-/p interactions at several energies. The spectra for the four reactions π/sup +-/p → π/sup +-/ + anything are compared as a function of laboratory longitudinal momentum, Feynman x, center of mass rapidity, and incident beam momentum, and the energy dependence is discussed. The charge distributions arising from π/sup +-/p interactions are compared and presented as a function of rapidity and beam energy.

7650 (LBL—6725) **Charmed meson production by e^+e^- annihilation.** Wiss, J.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1977. Contract W-7405-ENG-48. 156p. Dep. NTIS, PC A08/MF A01.

Thesis.

Compelling evidence is presented for the production of the lying (D^0, D^+) isodoublet of charmed mesons by e^+e^- annihilation. A study of the recoil mass spectra against these mesons reveals the presence of more massive charmed states, the D^{*0} and D^{*+}, produced in association with the D isodoublet. Mass values and upper limits on the width of the D and D* are established, and the branching fractions for several D* decay modes are obtained. An analysis of the production and decay angular distributions shows that the D is probably a pseudoscalar state and the D* is probably a vector. Finally, upper limits are obtained for D^0-antiD^0 mixing.

PARTICLE INTERACTIONS AND PROPERTIES - THEORETICAL

GENERAL

REFER ALSO TO CITATION(S) 7678, 7683

7651 (COO—2009-133) **Theoretical particle physics. Progress report, December 1, 1976—November 30, 1977.** Hendry, A.W.; Lichtenberg, D.B.; Weingarten, D.H. (Indiana Univ., Bloomington (USA). Dept. of Physics). Aug 1977. Contract EY-76-S-02-2009. 31p. Dep. NTIS, PC A03/MF A01.

Research during the past year covers a wide range of topics, and includes work on analyzing particle collisions, meson spectra from quark interactions, and gauge fields; work was done closely with several high energy experimental groups. An extensive partial wave analysis of pion-nucleon scattering up to 10 GeV/c was completed revealing many new high spin baryon resonances which correspond to high quark excitations. A one-gluon-exchange potential with linear confinement was examined to study mass spectra, with particular attention being paid to the latest interesting structures around 3.772 GeV at SLAC and 9.5 GeV at FNAL. In gauge fields, success was found in deriving several rigorous results dealing with Wilson's gauge theory on a lattice. Throughout the year, there was a continuation of work in close collaboration with experimentalists, not only at Indiana, but also at Iowa State and Argonne. Lastly in May, help was given to organize a two-day conference on the present status of weak interactions. A list of publications is presented.

7652 (COO—2220-108) **Quantum fluctuations of pseudoparticles in the nonlinear sigma-model.** Jevicki, A. (Institute for Advanced Study, Princeton, N.J. (USA)). Apr 1977. Contract EY-76-S-02-2220. 30p.

An investigation is presented of quantum fluctuations about pseudoparticle solutions in the two-dimensional σ-model. First, for the one pseudoparticle case, one solves the small oscillation problem and compute the first quantum correction to the classical result. In the two-pseudoparticle case, one transforms the small oscillation problem into an ordinary Schrodinger equation with an interaction depending on distance between the pseudoparticles. One can then solve the limiting cases of zero and infinite separations.

7653 (COO—2271-100) **Theoretical high energy physics. Progress report, May 1, 1976—April 30, 1977.** Lee, T.D.; Serber, R. (Columbia Univ., New York (USA). Dept. of Physics). May 1977. Contract EY-76-C-02-2771. 25p. Dep. NTIS, PC A02/MF A01.

Research on theoretical high energy physics is summarized. A list of publications is included. (JFP)

7654 **New pathways in high-energy physics I: magnetic charge and other fundamental approaches.** Perlmutter, A. (ed.). New York; Plenum Press (1976). 414p. (CONF-760124—P1).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

This volume of the conference proceedings contained 14 papers, one of which previously appeared in ERA. Separate abstracts were prepared for 13 papers. (JFP)

7655 **Elementary particles in the generalized theory of gravitation.** Kursunoglu, B. (Univ. of Miami, Coral Gables, FL). pp 15-120 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

For the time independent spherically symmetric fields, various regular solutions of the field equations are presented. An elementary particle structure consists of the entire spectrum of magnetic charges g/sub n/. The screening caused by the stratified distribution generates short range magnetic forces. The "bare gravitational mass" m, obtained as a constant of integration, is estimated to be of the order of 10^{21} MeV. The spectrum of fundamental lengths r/sub on/ [= Radical (2G/sub o/)/c^2 Radical (e^2 + g/sub n/^{2}) ~ 10^{-33}cm] measure the deviation of the theory from general relativity. The self-energy E/sub s/ in the limit r/sub on/ = O tends to infinity and the solutions reduce to the corresponding spherically symmetric solutions in general relativity. The spin ½ of an elementary particle is found to be the result of its neutral magnetic structure

and the latter exists only for nonvanishing Γ/sub [μν]//sup Rho/, the antisymmetric part of the affine connection. The two states of spin correlate with the two possible sequences of signs of g/sub n/, i.e., g/sub n/ and -g/sub n/, n = 0,1,2, ... For the solutions where e = O the symmetries of charge conjugation and parity are not conserved. The latter lead to the assumption of small masses for the two neutrinos ν/sub e/, ν/sub μ/. Conservation of the electric charge multiplicity i.e., the existence of -1, +1, 0 units of electric charge, is found to be the basis for the existence of four massive fundamental particles p,e,ν/sub e/, ν/sub μ/ and the corresponding antiparticles antip,e⁺,antiν/sub e/, antiν/sub μ/. Based on a new concept of "vacuum" predicted by the theory it may be possible to construct all other elementary particles as bound or resonance states of the "fundamental quartet" p,e,ν/sub e/,ν/sub μ/ and the "anti-quartet" antip,e⁺,antiν/sub e/,antiν/sub μ/.

7656 Gauging and breaking of simple supersymmetries. Freund, P.G.O. (Univ. of Chicago). pp 215-229 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

It is widely believed that the strong, electromagnetic, weak, and maybe even gravitational interactions can all be described by one unified gauge theory with spontaneous symmetry breaking. Although no such unified theory has been fully constructed as yet, it is clear that among its ingredients there must be spin ½ Fermi fields, spin 1 and 2 gauge fields, and spin 0 Nambu-Goldstone and Higgs fields. Depending on the interplay of these three types of fields one may consider three categories of theories: phenomenological gauge theories, pure gauge theories, and a relativistic version of BCS theory. 31 references. (JFP)

7657 Charge space, exceptional observables and groups. Guersey, F. (Yale Univ., New Haven). pp 230-248 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

It is shown that a class of exceptional quantum mechanical spaces represented by octonionic matrices and first introduced by Jordan, von Neumann and Wigner are suitable for representing the states of basic fermionic constituents (leptons and quarks) of elementary particles. In these exceptional spaces, the transformation groups that leave scalar products invariant are the exceptional groups. A gauge field theory based on E_7 is given as an example for the unification of weak, electromagnetic and strong interactions.

7658 Semiclassical quantization methods in field theory. Neveu, A. (California Inst. of Tech., Pasadena). pp 249-265 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

This is an overview of the semiclassical WKB method which can be applied to finding solutions to field theories which are inaccessible to perturbation techniques. In particular, it is possible to find solutions to the full nonlinear interacting classical equations of motion of various models, which behave like bound, stable field configurations in space-time, with particle properties. The method is based on general semiclassical formalism used for the computation of energy levels or particle masses in field theory. A WKB method is used to compute the particle spectrum of the gross-Neveu model. A rich spectrum classified in supermultiplets is found as a consequence of asymptotic freedom. The binding mechanism appears to be a vacuum polarization effect. 15 references. (JFP)

7659 New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976). 398p. (CONF-760124—P2).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

There were 18 papers presented, two of which appeared previously in ERA. Separate abstracts were prepared for 16 papers. (JFP)

7660 Diffraction scattering in quantum chronodynamics. Zachariasen, F.; Carruthers, P. (New York Univ., NY). pp 265-285 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

The previously proposed integro-differential equation whose solution is conjectured to collect all of the infrared singularities in all orders of g in the limit $\lambda \to 0$ (λ is a gluon mass cutoff introduced to render the theory infrared finite) is considered as a means of transcending perturbation theory and a means of dealing with the infrared aspects of high energy diffraction scattering. Quark—quark scattering is discussed. Some remarks are made on the scattering of color-singlet quark clusters with a view towards solving the physical problem. 14 references. (JFP)

7661 New model independent results on the diffraction peak. Cornille, H. (CEN-Saclay, France); Martin, A. pp 301-312 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

In the discussion of new model independent results on the diffraction peak an attempt is made to try to obtain as much as possible rigorous information from general principles. Included are the real part effects in the forward elastic peak, the scaling of elastic differential cross sections, and the extension of an inequality on the slope of the diffraction peak valid for arbitrary spin. 22 references. (JFP)

7662 Equation for density operator and scaling properties of inclusive cross section. Arkhipov, A.A.; Logunov, A.A.; Savrin, V.I. (Inst. for High Energy Physics, Serpukhov, USSR). pp 331-357 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

An equation for density operator of inclusive reaction that is connected with inclusive cross section via a simple relation was derived in the framework of equal-time formulation of the many-body problem in quantum field theory. The solution of this equation allows one to express the inclusive cross section through an effective quasipotential of screening. The results obtained are similar to scattering on a composite nucleon and is very close in spirit to the parton idea. A scaling character of inclusive cross section behavior is revealed as well as a power law decrease with increase in transverse momentum, with the help of some model assumptions with respect to the screening quasipotential.

ELECTROMAGNETIC INTERACTIONS

7663 Photoproduction of charmonium. Humpert, B. (Stanford Univ., CA). *Phys. Lett.;* **68B**: No. 1, 66-70(1977).

Photoproduction of ortho and para charm-anticharm bound states is considered in the framework of the Cheng-Wu picture. Non-Abelian gauge gluons mediate the interaction between the c anti c-pair and the nucleon. The angular distributions of psi/sub c/ and eta/sub c/ are determined. The influence of multigluon exchanges and quark mass variation is studied.

7664 Theory of magnetic monopoles. Dirac, P.A.M. (Florida State Univ., Tallahassee). pp 1-14 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

The treatment of magnetic monopole theory involves the Maxwell equations in a theory allowing both charges and monopoles co-existing and interacting with one another and involving the idea of a string, defined as a line extending from the monopole to infinity or terminating on a equal and opposite monopole. The change of gauge, the kinematics, and an action principle are considered. It is noted that the force on the monopole comes simply from the monopole being constrained to lie at the end of a string and the string variables occurring in the expression for the action of the field. (JFP)

7665 Electric charge in composite magnetic monopole theories. Goldhaber, A.S. (State Univ. of New York, Stony Brook). pp 121-133 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

It is observed that the spin approach to the interaction of electric charges with magnetic monopoles leads naturally to theories with composite monopoles made from SU(2) gauge fields. The key steps are to express the "electromagnetic field angular momentum" associated with a charge-pole system as a quantum-mechanical spin operator (as was done some years ago) and then to identify this spin operator as the generator of SU(2) transformations on charged-particle wave functions. It is emphasized that composite monopoles may not occur unless electric charge is one of the operators of an SU(2) symmetry. The formalism for conservation of electric charge, and quantization of the electric charge of a monopole, is developed at a "first-quantized"level. Speculations are given on high energy charge-pole scattering. Some problems with second quantization are discussed, and the possibility is raised that there may be an infinite mass renormalization of a composite monopole which has finite mass in the classical approximation. 20 references. (JFP)

7666 Noncovariance of the Schwinger monopole. Hagen, C.R. (Univ. of Rochester, NY). pp 135-149 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

It is shown that a canonical formulation of the magnetic monopole cannot be covariant if one allows only couplings which are manifestly invariant under three dimensional rotation. Although Schwinger's monopole theory allows a more general class of interaction terms, Lorentz invariance is found to be violated there as well. One is forced to conclude that there does not exist a consistent field theory of the monopole at the present time.

WEAK INTERACTIONS

REFER ALSO TO CITATION(S) 7655, 7682

7667 Theory of the direct four-fermion interaction. Makeenko, Yu.M.; Ter-Martirosyan, K.A.; Zamolodchikov, A.B. (Inst. for Theoretical and Experimental Physics, Moscow). pp 267-302 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

The solution of a coupled system of integral equations for the direct four-fermion interaction theory is obtained in the $d = 2 + \epsilon$ dimension space. It exists only for the SU(2) symmetric interaction and for the positive coupling constant G. It is scale invariant and corresponds to a stable fixed point of Gell-Mann - Low equations. The real four dimensional case $d = 4$ is considered. The same solution with a small change in the indices is shown to be approximately valid and all integrals in the equations are found to be convergent. The solution so obtained allows one to estimate the so-called "nonparquet" terms omitted in the set of equations. They are found to be numerically small. A general iteration procedure, with an obtained solution as a zero-order approximation is suggested.

7668 Possible structure of weak interaction. Zee, A. (Princeton Univ., NJ). pp 303-314 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

The treatment of weak interaction structure covers radiative weak decay of hyperons, the orientation of the weak interaction relative to that of the strong interaction, and radiative decays of heavy leptons including the existence of the new charmed heavy lepton U. 21 references. (JFP)

7669 Are SLAC (μe)-events decay products of integer charge quarks. Pati, J.C. (Univ. of Maryland, College Park); Salam, A.; Sakakibara, S. pp 315-330 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

It is remarked that the (μe)-events as well as the jet-structure observed at SPEAR may have their origin in the pair-production and decays of integer-charge quarks. Several experimental distinctions between quark versus heavy lepton-hypotheses for the (μe) events are noted.

7670 Signatures of vectorlike weak currents. Minkowski, P. (California Inst. of Tech., Pasadena). pp 345-387 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

The general framework of a vectorlike gauge theory of leptons, quarks, and gauge bosons is sketched and particular characteristic features involving the virtual excitation of heavy fermions which are entering the charged weak current right- and left-handedly are discussed and confronted with the nonleptonic decays of strange particles.

7671 Quark-tasting with neutrinos. De Rujula, A. (Harvard Univ., Cambridge, MA). pp 29-86 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

I review the current situation in neutrino physics in the context of unified gauge theories, with room for heavy quarks that carry new flavor quantum numbers. The y-anomaly is strong evidence for the existence of right-handed currents and perhaps beauty. Dileptons are evidence for charm. The case for truth is less compelling. One studies equal sign dileptons and their implications on a promising field of multilepton physics. Neutral currents, the hard-fact model and madness (nondiagonal neutral currents) are also among the topics discussed.

7672 How to compute the Cabibbo angle with six quarks. Glashow, S.L. (Harvard Univ., Cambridge, MA). pp 87-100 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

A demonstration is given of a possible calculation of the Cabibbo angle with six (or more) quark flavors. Also the development of quark theories is described including theories with three quarks, charm and strangeness, the discovery of charm in neutrino physics, and some previous quark models. (JFP)

STRONG INTERACTIONS, GENERAL

REFER ALSO TO CITATION(S) 7681

7673 Hadron states in the M.I.T. bag model. Johnson, K. (Massachusetts Inst. of Tech., Cambridge). pp 101-112 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

The main assumptions of the MIT bag model are reviewed. Then a summary is given of the principle consequences of hadron spectroscopy. Six references. (JFP)

STRONG INTERACTIONS, BARYON NO.=0

7674 (ANL-HEP-CP—77-31) Production and decay systematics of the A_1 resonance. Berger, E.L. (Argonne National Lab., Ill. (USA)). May 1977. Contract W-31-109-ENG-38. 10p. (CONF-770406—1). Dep. NTIS, PC A02/MF A01.

From 5. international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (29 Apr 1977).

A brief summary of the main points of a detailed study of diffractive production of resonance systems undertaken recently is presented. The A1 system is emphasized, but it is noted that the remarks can be readily generalized to other diffractive reactions such as $\pi p \rightarrow A_3 p$, $pp \rightarrow$ "N*(1400)"p, and $Kp \rightarrow$ "Q"p. The spins, parities, amplitude phase, and phase shift are among the properties considered. 4 references. (JFP)

7675 New particle spectroscopy and decays. Gilman, F.J. (Stanford Linear Accelerator Center, CA). pp 1-28 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Pelnum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

The phenomenological status of the spectroscopy and decays of new hadrons, both those possibly carrying a new quantum number (charmed particles) and those without it is discussed. 37 references. (JFP)

STRONG INTERACTIONS, BARYON NO.=1

REFER ALSO TO CITATION(S) 7620

7676 S-channel unitarity in the Pomeron theory with α/sub P/(0) > 1. Dubovikov, M.S.; Ter-Martirosyan, K.A. (Inst. for Theoretical and Experimental Physics, Moscow). pp 313-329 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

The integral equation defining the scattering amplitude in the form of the sum of all pomeron graphs contributions is obtained in the theory with α/sub P/(0) > 1. It is shown that for definite restrictions on the Cardy's vertex G/sub oo/(k^2) of the pomeron coupling, the solution of this equation in the xi, b-representation xi = ln(s/m)^2 is the simple amplitude Theta(a xi - b), with a = 4α'/sub P/.Δ, Δ = α/sub P/(0)-1. It leads to the Froissart type rising cross sections, and diffraction cone slopes: sigma/sup tot/ approximately B approximately xi^2. The theory in its simple version at G/sub oo/(k^2) = 0, yields a good description of existing experimental data at Δ = 0.07-0.08, at α'/sub P/ approximately equal to 0.3 and at the values of pomeron to particle coupling vertices given. It leads to the prediction of very large values of sigma/sub NN//sup tot/ approximately equal to sigma/sub kN//sup tot/ sigma/sub πN//sup tot/ approximately equal to 100 to 150 mb in the range of energies E/sub LAB/ approximately 10^5 to 10^{10} GeV available in the near future.

STRONG INTERACTIONS, BARYON NO. GREATER THAN 1

REFER ALSO TO CITATION(S) 7676

GENERAL

REFER ALSO TO CITATION(S) 7679

FIELD THEORY

REFER ALSO TO CITATION(S) 7627, 7652, 7656, 7657, 7658, 7660, 7662, 7684

7677 (ORO—3992-309) **Localized solutions of non-linear Klein—Gordon equations.** Werle, J. (Texas Univ., Austin (USA). Center for Particle Theory). May 1977. Contract EY-76-S-05-3992. 9p. Dep. NTIS, PC A02/MF A01.

Nondissipative, stationary solutions for a class of nonlinear Klein-Gordon equations for a scalar field were found explicitly. Since the field is different from zero only inside a sphere of definite radius, the solutions are called quantum droplets.

7678 (ORO—3992-311) **Fundamental length, bubble electrons and non-local quantum electrodynamics.** Hsu, J.P.; Mac, E. (Texas Univ., Austin (USA). Center for Particle Theory). Jun 1977. Contract EY-76-S-05-3992. 25p. Dep. NTIS, PC A02/MF A01.

Based on the concept of a bubble electron and the approach of Pais and Uhlenbeck, one constructs a finite quantum electrodynamics which is relativistically invariant, macro-causal and unitary. In this model, fields and their interaction are local, but the action function of free fields is nonlocal. The propagators are modified so that a fundamental length L is naturally introduced to physics. The modified static potential is given by V(r) = e/r for r greater than L and V(r) = 0 for r less than L, which is produced by the bubble source r^{-1}ddelta(r-L)/dr rather than a point source. It is found that L less than 4 x 10^{-15} cm. Experimental consequences and modifications of strict causality at short distances, vertical bars^{2}vertical bar approximately L^2, are discussed.

7679 Spontaneous breaking of supersymmetry in non-Abelian gauge theories. Slavnov, A.A. (Steclov Mathematical Inst., Moscow). pp 331-344 of In New pathways in high-energy physics I: magnetic charge and other fundamental approaches. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P1.

A mechanism is proposed for spontaneous supersymmetry breaking which is in some sense generalization of Fayet—Illiopoulos method but is applicable to the theories invariant with respect to the semi-simple gauge group. The group of invariance of the model should be G(local) x U(1) (global), where G can be semi-simple. The main observation is that to produce supersymmetry breaking the Abelian subgroup U(1) should not be realized dynamically. Consequently, the method works in the case of supersymmetric Yang—Mills theory and in particular allows one to construct asymptotically free and infrared convergent models. 13 references. (JFP)

7680 Some recent work on zero mass field theories. Appelquist, T. (Yale Univ., New Haven). pp 199-211 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

Some new results on the zero mass behavior of renormalizable field theories are reviewed. Much of the work is directed toward the problem of defining finite transition probabilities in theories with coupled massless fields. In particular, it was shown through lowest nontrivial order that the production, scattering and detection (with finite energy resolution) of massive quarks in the unbroken SU(3) color gauge model is free of infrared divergences in perturbation theory.

7681 Infrared singularities of non-Abelian gauge theories. Cornwall, J.M.; Tiktopoulos, G. (Univ. of California, Los Angeles). pp 213-230 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

The Feynman graphs were calculated for the infrared singularities of non-Abelian gauge theories. The results are characterized by certain properties of exponentiation and factorization summarized by a differential equation in the infrared cutoff (μ). the $\mu^2/2\mu$ equations, applications to the near-forward regime, the KLN theorem versus confinement and the relevance of perturbation theory, and implications for hadronic physics and prognostications are treated. 14 references. (JFP)

7682 Freedom now: a new look at the impulse approximation. Politzer, H.D. (Harvard Univ., Cambridge, MA). pp 231-242 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

Recent work on a field-theoretic impulse approximation is described. The operator product expansion is organized according to powers of g(Q^2), the effective coupling constant appropriate to momentum transfer Q^2, instead of asymptotic dimensional analysis. This allows the calculation of all quark and target mass dependence of lepton-hadron inclusive scattering, order by order in g(Q^2). To O(g^0), there is scaling in a mass dependent variable, ξ. The correct incorporation of quark masses into the renormalization group analysis is presented; the consequences include the relation of constituent masses to current algebra and the magnitude and shapes of the parton distribution functions for gluons, antiquarks, and heavy quarks.

7683 Relativistically invariant lattice theories. Wilson, K.G. (Cornell Univ., Ithaca, NY). pp 243-263 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

It is shown that the quantum field theories on a Euclidean space time lattice can be derived which have the same S matrix (after analytic continuation to the Lorenz metric) as a relativistic continuum theory. The lattice spacing of the lattice theory is fixed; no limit of zero lattice spacing is required. It is proposed that (as already discussed) a lattice theory be derived as an intermediate step in solving the asymptotically free color gauge theory. (JFP)

SCATTERING THEORY

7684 High energy behavior of two-body elastic amplitudes in gauge field theories. McCoy, B.M. (State Univ. of New York, Stony Brook); Wu, T.T. pp 287-300 of In New pathways in high-energy physics II: new particles; theories and experiments. Perlmutter, A. (ed.). New York; Plenum Press (1976).

From Conference of the ORBIS SCIENTIAE, center for theoretical studies; Coral Gables, Florida, United States of America (USA) (19 Jan 1976).

See CONF-760124—P2.

In the treatment of high energy behavior of two-body elastic amplitudes in gauge field theory one considers only the limit $s \rightarrow \infty$, with t fixed at a physical value. The cases discussed include the Abelian gauge theory (electrodynamics) with pomeron and quantum number exchange and non-Abelian gauge theory (Yang—Mills) theory. 23 references. (JFP)

PHYSICS RESEARCH (CONT.)

NUCLEAR PROPERTIES AND REACTIONS, A=1-5, EXPERIMENTAL

NUCLEAR REACTIONS AND SCATTERING

7685 (COO—2146-11) **Program in medium energy nuclear physics research. Technical progress report, 1 September 1976—30 November 1977.** Willard, H.B. (Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Physics). 31 Aug 1977. Contract EY-76-S-02-2146. 40p. Dep. NTIS, PC A03/MF A01.

Experimental results are reported on single and double pion production in proton—proton collisions at 800 MeV, reaction cross sections for 700 MeV protons incident upon ^{40}Ca, ^{44}Ca, and ^{48}Ca, the polarization analyzing power A/sub y/(Θ) for 800 MeV proton—proton elastic scattering, and pion capture spectra for tritium and ^{20}Ne. The LAMPF polarized beam, a polarimeter, and a polarized target, are also discussed. The design and test results on the detector elements of the high resolution π^0 spectrometer are presented. A list of publications is included.

NUCLEAR PROPERTIES AND REACTIONS, A=39-58, EXPERIMENTAL

REFER ALSO TO CITATION(S) 7685

ENERGY LEVELS AND TRANSITIONS

REFER ALSO TO CITATION(S) 7686

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 7685

7686 (ANL/NDM—31) **Titanium-I: fast neutron cross section measurements.** Guenther, P.; Havel, D.; Smith, A.; Whalen, J. (Argonne National Lab., Ill. (USA)). May 1977. Contract W-7405-ENG-38. 34p. Dep. NTIS, PC A03/MF A01.

Energy averaged total neutron cross sections are measured from approximately 1.0 to 4.5 MeV with few percent statistical accuracies. Differential elastic neutron scattering angular distributions are measured from 1.5 to 4.0 MeV at incident neutron energy intervals of ≦ 0.2 MeV. Differential cross sections for the inelastic neutron excitation of "states" at 158 +- 26, 891 +- 8, 984 +- 15, 1428 +- 39, 1541 +- 30, 1670 +- 80, 2007 +- 8, 2304 +- 22, 2424 +- 16, and 2615 +- 10 keV are measured for incident neutron energies from 1.5 to 4.0 MeV. Additional "states" are observed at approximately 2845 and 3009 keV. An energy-averaged optical-statistical model is deduced from the measured values and the implications of its use in the context of the strong fluctuating structure is discussed.

NUCLEAR PROPERTIES AND REACTIONS, A=90-149, EXPERIMENTAL

NUCLEAR REACTIONS AND SCATTERING

7687 (COO—1505-86) **Deexcitation processes in nuclear reactions. Progress report, May 1, 1976—July 31, 1977.** Porile, N.T. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Chemistry). Aug 1977. Contract EY-76-S-02-1505. 21p. Dep. NTIS, PC A02/MF A01.

A number of nuclear reaction studies are in progress. Measurements of the energy dependence of recoil properties of ^{131}Ce, ^{131}La, and ^{131}Ba formed in the interaction of ^{238}U with 0.8-400 GeV protons are described. Preliminary results on the angular distribution and differential ranges of Sc and Ba nuclides formed in the interaction of ^{238}U with 0.8, 3.0, and 11.5 GeV protons are given. Preliminary angular distribution measurements of products formed in the interaction of ^{238}U with 400 GeV protons are described. A comparative study of the interaction of silver with 25.2 GeV ^{12}C ions and high energy protons is described and results of the analysis of the proton data are presented. The formation of ^{24}Na in the interaction of gold with protons and π^+ was studied and preliminary results are reported. A list of publications is included. (JFP)

NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, THEORETICAL

SPONTANEOUS AND INDUCED FISSION

7688 (LA-NUREG—6896-MS) **Comparisons of calculated and experimental delayed fission-product beta and gamma spectra from ^{235}U thermal fission.** England, T.R.; Stamatelatos, M.G. (Los Alamos Scientific Lab., N.Mex. (USA)). Jul 1977. Contract W-7405-ENG-36. 64p. Dep. NTIS, PC A04/MF A01.

Delayed fission-product beta and gamma spectra following short and long ^{235}U thermal neutron irradiations (0.015 s, 1 s, 10 s, 100 s, 5.56 h, and 8 h) were calculated for a number of cooling periods. The results of these calculations, based on ENDF/B-IV fission-product data, are compared with corresponding experimental data available recently from several research establishments (Los Alamos Scientific Laboratory, Oak Ridge National Laboratory, and the University of Illinois). These comparisons show generally good agreement between calculations and experiments and indicate the adequacy of ENDF/B-IV data for such calculations. 112 graphs.

NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, EXPERIMENTAL

SPONTANEOUS AND INDUCED FISSION

REFER ALSO TO CITATION(S) 6642

7689 Delayed neutron yield calculations for the neutron-induced fission of uranium-235 as a function of the incident neutron energy. Alexander, D.R.; Krick, M.S. (Kansas State Univ., Manhattan). *Nucl. Sci. Eng.;* **62**: No. 4, 627-635(Apr 1977).

The total delayed neutron yield from ^{235}U was calculated as a function of the energy of the neutron inducing fission. The calculations (based on fission data and fission systematics) extend from thermal to 15-MeV neutron energies. The energy-dependent delayed neutron calculations are generally consistent with experimental results from thermal to 14-MeV neutron energies. Delayed neutron yields per 10^4 fissions of 168.7 +- 16.7, 178.2 +- 17.2, and 88.9 +- 10.0 were obtained at thermal, fission-spectrum, and 15-MeV neutron energies, respectively. The energy dependence of the odd-even effect in the fission charge distribution was found to partially account for the near constant yield observed below 5-MeV neutron energy, as well as the rapid decrease in yield observed at the second-chance fission threshold.

7690 Measured near-equilibrium delayed neutron spectra produced by fast-neutron-induced fission of ^{232}Th, ^{233}U, ^{235}U, ^{238}U, and ^{239}Pu. Eccleston, G.W.; Woodruff, G.L. (Univ. of Washington, Seattle). *Nucl. Sci. Eng.;* **62**: No. 4, 636-651(Apr 1977).

Measurements of the near-equilibrium energy spectra of the delayed neutrons associated with fast-neutron-induced fissions of ^{232}Th, ^{233}U, ^{235}U, ^{238}U, and ^{239}Pu are reported over the energy range from 35 to 1500 keV. The fission source spectrum, produced from the ^{9}Be(p,n)^{9}B reaction using 10-MeV protons, approximated a prompt fission spectrum. Over 20% of the delayed neutrons in the measured spectra for each sample appeared below 100 keV. Two large peaks at 41 and 74 keV were observed in the spectra from each nuclide. The measured spectra compare favorably with the data reported by others at energies above 200 keV. However, at energies below this value, our results show a significant increase in the number of delayed neutrons when compared with previously published results.

7691 Equilibrium delayed neutron spectra from fast fission of uranium-235, uranium-238, and plutonium-239. Evans, A.E.; Krick, M.S. (Los Alamos Scientific Lab., NM). *Nucl. Sci. Eng.;* **62**: No. 4, 652-659(Apr 1977).

A ^{3}He neutron spectrometer has been used to measure the energy spectra of delayed neutrons in equilibrium with fission induced by sub-MeV neutrons incident upon ^{235}U, ^{238}U, and ^{239}Pu. Full contribution of shorter lived delayed neutron groups not previously measured was ensured by bombarding samples for 35 out of every 100 ms and measuring delayed neutrons for 40 ms between each bombarding pulse. Results show delayed neutron spectra of somewhat higher average energy than have previously been reported. Examination of the energy end points of delayed neutron emitters as a function of precursor half-life shows that the higher average delayed neutron energies are probably due to the inclusion of neutrons from the shorter lived precursors.

NUCLEAR THEORY

NUCLEAR REACTIONS AND SCATTERING

7692 (LBL—6525) **Pionic instabilities in high-energy heavy ion collisions.** Gyulassy, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1977. Contract W-7405-ENG-48. 22p. (CONF-770602—3). Dep. NTIS, PC A02/MF A01.

From Proceedings of macroscopic properties of heavy ion collision; Pikeville, Tennessee, United States of America (USA) (12 Jun 1977).

The study of heavy ion reactions includes the determination of whether pionic instabilities can exist at the densities and excitation energies expected in heavy ion collisions, the calculation of growth rates of unstable pion modes, and the determination of the effect such instabilities would have on the dynamics in heavy ion collisions. 14 references. (JFP)

7693 (LBL—6587) **Charge and angular distributions as well as sequential decay and γ-ray emission in heavy ion collisions viewed in the light of the diffusion model.** Moretto, L.G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1977. Contract W-7405-ENG-48. 57p. (CONF-770927—2). Dep. NTIS, PC A04/MF A01.

From Symposium on macroscopic features of heavy-ion collisions and pre-equilibrium processes; Hakone, Japan (2 Sep 1977).

The hierarchy of the collective relaxation times in heavy ion reactions is briefly reviewed. An improved diffusion model is introduced and applied to interpret the fragment Z and angular distributions for some typical reactions. The equilibrium in the neutron-to-proton ratio as well as the sharing of the excitation energy between fragments is studied by a coincidence method which leads to the measurement of the charge, mass and mean number of nucleons emitted by each fragment. The final destiny of the dissipative energy is determined by measuring the atomic number of two coincident fragments, thus obtaining the missing charge as a function of bombarding energy and the Q of the reaction. The sequential fission probability of the heavy recoil is established as a function of the Z and kinetic energy of the light partner. The out-of-plane angular distribution of the fission fragments is correlated with the fissionability and interpreted in terms of various sources of angular momentum misalignment. The γ-ray multiplicities and the γ-ray angular distributions associated with deep inelastic event are discussed in terms of the angular momentum transfer and in terms of the diffusion model.

7694 (UCID—17564) **Multigroup constants for charged particle elastic nuclear (plus interference) scattering of light isotopes.** Cullen, D.E.; Perkins, S.T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Aug 1977. Contract W-7405-ENG-48. 22p. Dep. NTIS, PC A02/MF A01.

Multi-group averaged reaction rates and transfer matrices were calculated for charged particle induced elastic nuclear (plus interference) scattering. Results are presented using a ten group structure for all twenty-five permutations of projectile and target for the following charged particles: p, d, t, ^{3}He and alpha. Transfer matrices are presented in a simplified form for both incident projectile and the knock-ons; these matrices explicitly conserve energy.

RADIATION AND SHIELDING PHYSICS

RADIATION PHYSICS

REFER ALSO TO CITATION(S) 7100, 7700

7695 **Intermediate energy approximation of the Bethe-Heitler formula for the bremsstrahlung cross-sections.** Gopala, K.; Sanjeevaiah, B. (Univ. of Mysore, India). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 60-63(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

Bremsstrahlung cross section calculations are still attracting attention because of the inadequacy of the existing formulae. The Sommerfeld-Elwert formula holds good up to 0.1 MeV. Bethe and Heitler gave a relativistic expression for the bremsstrahlung cross sections using Dirac's electron theory and Born approximation. Coulomb and screening effects were not included in their calculations. Calculations of the bremsstrahlung cross sections using the B-H formula are tedious. Approximations of the B-H formula in the nonrelativistic and extreme relativistic regions exist. But no such approximation is available in the intermediate energy region. An attempt is made to obtain an approximation of the B-H formula in the intermediate energy region. Several approximations are made to reduce the B-H formula into a polynomial in x, the ratio of the photon energy to the total energy of the incident electron. The coefficients of the polynomial turn out to be a long series of terms which are functions of incident electron energy. The validity of the approximate formula in the intermediate energy region will be discussed.

SHIELDING CALCULATIONS AND EXPERIMENTS

REFER ALSO TO CITATION(S) 6686, 7702

7696 **Monte Carlo shielding calculations using event-value path-length biasing.** Tang, J.S. (Oak Ridge National Lab., TN); Hoffman, T.J.; Stevens, P.N. (Oak Ridge National Lab., TN). *Nucl. Sci. Eng.;* **62**: No. 4, 617-626(Apr 1977).

The role of the event-value and the point-value functions in importance sampling is clearly defined. A biasing technique that alters the transport kernel using the event-value function is developed. This path-length biasing technique is demonstrated by application to a deep penetration shielding problem. The results indicate a substantial reduction in computational cost over the standard exponential transform or adjoint flux biasing of the collision site selection.

NEUTRON INTERACTIONS WITH MATTER

REFER ALSO TO CITATION(S) 6681, 6682

7697 (CONF-771031—7) **Small-angle neutron scattering of reactor-irradiated niobium.** Spooner, S.; Child, H.R.; Wiffen, F.W. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 10p. Dep. NTIS, PC A02/MF A01.

From 21. conference on analytical chemistry in energy technology; Gatlinburg, Tennessee, USA (4 Oct 1977).

Analysis of neutron irradiated Nb and 1 percent Zr—Nb specimens was undertaken with small angle neutron scattering in order to assess the feasibility of using the technique to supplement methods of transmission electron microscopy of void structure. Measurable scattering was obtained by utilizing the advantages of the Borkowski-Kopp area position sensitive detector, and comparisons between the methods can be made. (GHT)

7698 (COO—2280-36) **Computational complexity in multidimensional neutron transport theory calculations. Progress report, September 1976—November 30, 1977.** Bareiss, E.H. (Northwestern Univ., Evanston, Ill. (USA)). Aug 1977. Contract EY-76-S-02-2280. 14p. Dep. NTIS, PC A02/MF A01.

The objectives of this research are to develop mathematically and computationally founded criteria for the design of highly efficient and reliable multidimensional neutron transport codes to solve a variety of neutron migration and radiation problems, and to analyze existing and new methods for performance.

7699 (EURFNR—1450) **KEDAK program compendium. Part V. KEDAK evaluation aids.** Froehner, F.H. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Apr 1977. 229p. (KFK—2387/5). Dep. NTIS (US Sales Only), PC A11/MF A01.

Work performed under United States—Euratom Fast Reactor Exchange Program.

Part V of the KEDAK Program Compendium contains descriptions of the more important codes that are used in KEDAK evaluation work at Karlsruhe, in particular: check programs, programs performing arithmetic operations on whole data sets, programs for weighting and smoothing and programs for etimation of nuclear-model and cross section parameters.

7700 **Asymptotic evaluation of two families of integrals.** Kaper, H.G. (Argonne National Lab., IL). *J. Math. Anal. Appl.;* **59**: No. 3, 415-422(Jul 1977).

The integrals f/sub mv/(tau) = $\int_0$/sup infinity/ exp[-(t + tau)]t/sup v/(ln t)/sup m/(t + tau)$^{-1}$ dt and g/sub mv/(tau) = $\int_0$/sup infinity/ exp[- parallel t - tau parallel]t/sup v/(ln t)/sup m/(t - tau)$^{-1}$ dt are investigated for positive real values of the variable tau. Here, m is a nonnegative integer, v is a complex variable with Re(v) greater than -1. Both integrals are related to the complex integral PHI/sub m gamma/(z) = $\int_0$/sup infinity/ exp[-(t - z)]t^{-}/sup -

gamma/(ln t)/sup m/(t - z)$^{-1}$ dt with 0 less than or equal to Re(γ) less than 1, the behavior of which is analyzed in detail. The results are applied to obtain asymptotic representations for f/sub mn/(tau) and g/sub mn/(tau), m and n both nonnegative integers, near tau = 0. The latter integrals play a role in the study of the equations of neutron transport and radiative transfer.

7701 New method for the measurement of differential elastic scattering cross sections of fast neutrons. Nath, S.; Chatterjee, A.; Ghose, A.M. (Bose Inst., Calcutta). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 64-66(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

A new method has been described which successfully reduces the problem of low scattering intensity. The scatterer has been taken in the form of a spheroid. The elastically scattered neutrons have been discriminated from the inelastically scattered ones by using multiple bias technique. Experimentally measured values of differential elastic scattering cross sections for sulfur at four angles for 14 MeV neutrons have been presented. The results have also been compared with the optical model prediction.

7702 Neutron dose evaluation using calculated neutron spectra. Makra, S. (Central Research Inst. for Physics, Budapest). *Natl. Bur. Stand. [U.S.], Spec. Publ.;* No. 461, 238-246(Jan 1977).

From International symposium on radiation physics; Calcutta, India (30 Nov 1974).

See CONF-741109—.

Measurements carried out at shielded neutron sources such as nuclear reactors and neutron generators showed the importance of intermediate energy neutrons not recorded by most of the commonly used monitors. Based on these measurements correction factors were established for scintillation survey instruments, track plates, activation detectors and other routinely used devices. Although this simple technique has proved to be very useful, the need for a more sophisticated evaluation method was evident. With this in mind we started with the calculation of neutron spectra transmitted through and reflected from shielding slabs. Calculations were performed by using the MUSPALB albedo code developed in our Institute as well as with the O5R code written in Oak Ridge, USA. Over the last four years spectra for different reactor and neutron generator sources with H_2O, polyethylene, concrete, beryllium, aluminum, graphite, iron, boron loaded polyethylene and iron-concrete mixture shields were calculated for thicknesses ranging from 5 cm to 200 cm. Calculated spectra were used for personnel-, survey-, and nuclear accident dosimetry evaluation. International comparison measurements have shown the value of this evaluation method. For illustration several examples are given.

RADIATION SOURCE CALIBRATION AND STANDARDIZATION

REFER ALSO TO CITATION(S) 7505

SOLID STATE PHYSICS

7703 (BNWL-tr—256) **Correlation between atomic transitions: a new method of calculation.** Benoist, P.; Bocquet, J.L.; LaFore, P. Translated from *Acta Metall.;* **25**: 265-275(1977). 30p. Dep. NTIS, PC A03/MF A01.

All the methods used until now for treating the correlation have been approximate: they do not permit the defect responsible for diffusion to recede to infinity in the crystal. One presents a rigorous method permitting an exact calculation of the correlation by means of a double Fourier-Laplace transformation. This new method makes it possible simultaneously: to reformulate synthetically all the correlation problems previously treated sporadically in the literature; to treat problems never yet solved (effect of the concentration of vacancies on the correlation factor; self-diffusion by dissociated interstitial.

7704 (LA-UR—77-2063) **Scattering theory and effective medium approximations to heterogeneous materials.** Gubernatis, J.E. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 14p. (CONF-770925—2). Dep. NTIS, PC A02/MF A01.

From Electrical transport and optical properties of inhomogeneous media conference; Columbus, Ohio, USA (7 Sep 1977).

The formal analogy existing between problems studied in the microscopic theory of disordered alloys and problems concerned with the effective (macroscopic) behavior of heterogeneous materials is discussed. Attention is focused on (1) analogous approximations (effective medium approximations) developed for the microscopic problems by scattering theory concepts and techniques, but for the macroscopic problems principally by intuitive means, (2) the link, provided by scattering theory, of the intuitively developed approximations to a well-defined perturbative analysis, (3) the possible presence of conditionally convergent integrals in effective medium approximations.

7705 (SAND—77-6017) **Quantum theoretical calculation of the alkali halide lattice.** Jensen, H. Translated by P. Newman from *Z. Phys.;* **101**: 164-185(1936). 31p. Dep. NTIS, PC A03/MF A01.

The statistical method is used to calculate the interaction of the ion branches in the alkali halides and the reliability of the alkali halides and the reliability of the method is examined. A defect in the theory which resulted in uncertainty in a quantitative aspect in an earlier application is eliminated, in particular exchange is taken into account. The previously obtained result is confirmed, showing that the Born repulsion forces are not based on electrostatic effects, but are based on the Pauli principle. For quantitative details it is important in this technique to take exchange into account, however it is of less importance for an understanding of interaction forces. The lattice constants are found in a first approximation (omitting deformation) to be about 10 percent too large, but agreement with the experimental values is improved by more electron-rich the building blocks of the lattice. Calculated compressibilities and infrared frequencies deviate more from the experimental values, and the reason for this is explained. The second approximation is made only roughly, and generally improves agreement with experimental values.

SOLID STATE PLASMA

REFER ALSO TO CITATION(S) 7116

SUPERCONDUCTIVITY

ACOUSTIC, ELECTRIC, MAGNETIC, OPTICAL, AND THERMAL PHENOMENA

7706 Pressure dependence of T/sub c/ for the shear-stress-induced tetragonal phase of V_3Si. Shelton, R.N. (Univ. of California, San Diego La Jolla); Johnston, D.C.; Viswanathan, R. *Mater. Res. Bull.;* **12**: No. 2, 133-136(Feb 1977).

The effect of hydrostatic pressure on the superconducting transition temperature (T/sub c/) of the shear-stress-induced tetragonal phase of V_3Si (T/sub c/ approximately 10 K, c/a approximately 1.05) is reported for the first time. The T/sub c/ of this phase increases linearly with pressure at a rate of (1.0 +- 0.1) x 10^{-5} K bar^{-1}, substantially lower than values of dT/sub c//dp previously reported for the other two phases of V_3Si.

THEORETICAL PHYSICS

RELATIVITY AND GRAVITATION

REFER ALSO TO CITATION(S) 7655, 7656

OPTICS

7707 (LA-tr—77-28) **OPTICS: use of total reflection for the study of thin layers with low absorbance.** Abeles, F.; Bazin, C. Translated from *C. R. Hebd. Seances Acad. Sci.;* **254**: 2310-2312(1962). 6p. Dep. NTIS, PC A02/MF A01.

The explicit formulas used to calculate the reflectance for an absorbing thin layer used at an angle of incidence corresponding to total reflection at the layer—air boundary are set forth. A comparison is drawn between the absorptions obtained in this case and in the case of incidence along the normal direction. Formulas are developed which permit a simplified calculation of the complex refractive index of the thin layer from measurements of the reflectance for vibrations perpendicular and parallel to the plane of incidence, if the thickness of the layer and the angle of incidence are known.

ELECTRICITY AND MAGNETISM

7708 (SAND—77-1203) **Sympathetic breakdown in air.** Brainard, J.P.; Andrews, L.A. (Sandia Labs., Albuquerque, N.Mex. (USA)). Aug 1977. Contract EY-76-C-04-0789. 19p. Dep. NTIS, PC A02/MF A01.

Sympathetic breakdown is observed between adjacent gaps in ambient air up to 0.4 m apart, and is found to be due to ultraviolet light. The ultraviolet light generated by the first gap breakdown initiates a breakdown in the second gap. The initiation time depends on the electric field in the second gap. Sympathetic breakdown can be induced in a gap having a field as low as 50% of the normal breakdown field, but the initiation time becomes relatively large (0.1 μS). At a spacing of 30 mm between the gaps, the first gap must break down at a voltage greater than 500 V to initiate the breakdown of the second gap. At 1600 V sympathetic breakdown operates over a distance of at least 0.4 m. Sympathetic breakdown is thought

to play a major role in the breakdown of the lightning arrestor connector. 10 figs. (LAC)

7709 (UCID—17440) **Observations on the operation of the SEMPEX code.** Hudson, H.G.; Lager, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Sep 1977. Contract W-7405-ENG-48. 50p. Dep. NTIS, PC A03/MF A01.

Observations on the use of the SEMPEX computer code are given. The issues of proper sampling rate and total sampling interval are addressed. The effect that noise in the data has on the results and the ability of autocorrelation, truncation filtering, and the sliding-window technique to reduce these effects are also discussed. 35 figures, 24 tables.

MATHEMATICAL PHYSICS

7710 (ORNL/TM—6053) **Time-dependent Hartree—Fock theory in a two-dimensional rotating frame.** Feldmeier, H.T. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 19p. Dep. NTIS, PC A02/MF A01.

From a variational principle, which is equivalent to Schroedinger's equation, equations are derived which allow one to describe a system of axial symmetry rotating around an axis perpendicular to the symmetry axis. Expressions are given for the moment of inertia, the angular velocity, and the contribution of the rotational energy to the total kinetic energy.

7711 (UCRL—80121) **Numerical study of particle motion in two waves.** Smith, G.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Sep 1977. Contract W-7405-ENG-48. 15p. (CONF-770692—1). Dep. NTIS, PC A02/MF A01.

From International conference on stochastic behavior and quantum hamiltonian systems; Tremezzo, Italy (20 Jun 1977).

One studies the dynamical system described by the Hamiltonian $H = H_0 + E V$, where $H_0 = {}^1/_2 p^2 - \cos x$, $V = -\cos(\lambda x - \Omega t)$. One encounters this system in a number of problems of practical importance. In addition, the system has intrinsic interest for the theory of adiabaticity and stochasticity. The invariant action J of the unperturbed Hamiltonian H_0 is subject to strong modification or destruction because of the perturbation E V. Absence of an invariant (i.e., stochasticity) occurs in a phase space region whose size and shape vary with the three parameters E, lambda, Ω. Previous studies have varied the amplitude of a perturbation (our epsilon); one emphasizes the strong dependences on the space (lambda) and time (Ω) scales of the perturbation. Results show that a perturbation is most effective at causing stochastic motion if its space and time scales are comparable ($\lambda - 1$, $\Omega - 1$) to those in the unperturbed Hamiltonian H_0.

7712 **Generalization of the Gauss hypergeometric series.** Louck, J.D. (Los Alamos Scientific Lab., NM); Biedenharn, L.C. *J. Math. Anal. Appl.;* **59**: No. 3, 423-431(Jul 1977).

A generalization of the Gauss hypergeometric function to t variables is given, and the Euler identity is shown to hold for this generalized function. The corresponding generalization of the Saalschutz theorem is also obtained.

7713 **Local distortion technique, resonances, and poles of the S-matrix.** Jensen, A. (Aarhus Univ., Denmark). *J. Math. Anal. Appl.;* **59**: No. 3, 505-513(Jul 1977).

Two-body Schrodinger Hamiltonians of the form $H = H_0 + Q$ on $L^2(R^3)$, where H_0 is the free Hamiltonian and Q the interaction, are considered. The main result is the fact, proved as a theorem, that the poles of S(E) and the resonances agree. Moreover, one explicitly constructs an isomorphism of the space of resonance states at z_0 and the null space of $S^s(\text{anti } z^2{}_0)$. (JFP)

FUSION ENERGY

7714 (TID—3557-S12) **Controlled fusion and plasma research: a literature search.** Whitson, M.O. (comp.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jun 1977. 848p. Dep. NTIS, PC A99/MF A01.

This bibliography contains 4723 references to journal and report literature related to various aspects of controlled fusion research. Corporate author, personal author, report number, and subject indexes are included.

PLASMA RESEARCH

PLASMA CONFINEMENT AND HEATING

REFER ALSO TO CITATION(S) 7739, 7764

7715 (AD—716860) **Computer simulation experiments on electrostatic—inertial confinement. Final report.** Barnes, C.W. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Sep 1970. 15p. (SU-IPR—391). NTIS, PC A02/MF A01.

The inertial confinement scheme is a proposed method of containing a hot, dense fusion plasma by purely electrostatic means, that is to say, without the use of externally applied rf fields or dc magnetic fields. The fusion gases are confined by the inertia of high energy beams of particles focused at the plasma from all sides. Although, as now conceived, the scheme involves the high energy injection of ions, it was originally thought of as a device in which electrons were injected with high energy.

7716 (CONF-770906—4) **Relation of neutral beam injection to impurity behavior and extension of plasma parameters on ORMAK.** Lyon, J.F.; Isler, R.C.; Murakami, M. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From 8. European conference on controlled fusion and plasma physics; Prague, Czechoslovakia (19 Sep 1977).

Neutral beam injection extends the plasma parameter range (n_e, β, T_i, q, T_e) in ORMAK over that obtainable with ohmic heating alone. Impurity radiation also increases due to the added power, especially with counterinjection. Impurity trapping of injected beam neutrals is observed, but the large toroidal rotation velocities expected for unidirectional injection do not occur.

7717 (COO—2323-6) **Potential well formation in electrostatic confinement devices. Technical progress report.** Cherrington, B.E.; Verdeyen, J.T. (Illinois Univ., Urbana (USA). Gaseous Electronics Lab.). 1976. Contract EY-76-S-02-2323. 23p. Dep. NTIS, PC A02/MF A01.

Electron injection experiments on the large spherical inertial electrostatic plasma confinement devices have been extended to much higher voltages and currents (up to 10 kV and up to 25 A). Electron beam diagnostics have verified the production of a deep negative electrostatic well under high vacuum conditions and a multiple potential well when low pressure deuterium is added. A movable electrostatic probe has been constructed and has been used to show that the ions produced within the chamber can be focussed towards the center of the device with very low divergence. Additional theoretical work has been done to clarify the electron and ion parameters for which a triple well structure (trapped ions or trapped electrons) can be expected to be produced. A small hydrogen negative ion source has been constructed and is under study as a possible source for ion diagnostics.

7718 (EPRI-ER—394-SR) **Overview of stoppering of open magnetic containment systems for controlled fusion.** Hinrichs, C.K.; Lichtenberg, A.J.; Dolan, T.J. (Electric Power Research Inst., Palo Alto, Calif. (USA)). Jun 1977. 46p. Dep. NTIS, PC A03/MF A01.

Magnetic confinement systems with the field lines leading out of the system are subject to end loss. The rate of end loss must be reduced to a sufficiently small value in a reactor such that fusion energy is generated more rapidly than energy is lost. The basic open ended systems either have too high an end loss to satisfy the reactor criterion (single mirrors and cusps), or are too long to be considered practical (long solenoids). Various end stoppering schemes have been proposed to reduce the end loss of open ended systems, and thus make the energy balance more favorable. The end stoppering techniques reviewed in this paper are electrostatic, r.f., magnetic, material walls, and hybrid systems. We summarize here the more important characteristics and the potentialities of the first three methods of end stoppering. End stoppering with material walls has been insufficiently explored for further comment and hybrid systems, being mainly beyond the scope of this report, have been summarized in the main text.

7719 (LA—6625-P) **Proposal for the ZT-40 reversed-field Z-pinch experiment.** Baker, D.A.; Machalek, M.D. (comps.). (Los Alamos Scientific Lab., N.Mex. (USA)). Aug 1977. Contract W-7405-ENG-36. 39p. Dep. NTIS, PC A03/MF A01.

A next-generation, toroidal, reversed-field Z-pinch experiment to be constructed at LASL is proposed. On the basis of encouraging ZT-I and ZT-S experimental results, a larger device with a 40-cm bore and a 114-cm major radius is proposed, to extend the confinement time by about an order of magnitude. The new experiment will explore the physics of programming reversed-field pinches in a size range unexplored by previous reversed-field pinch experiments. Model reversed-field pinch reactor calculations show that, if stability is assumed, small fusion reactors are possible if the pinch current density is high. A basic aim will be to delineate the plasma and current density ranges in which stable reversed-field pinches can be produced. Improved vacuum techniques will be used to overcome the radiation losses that probably kept electron temperatures low in the earlier, smaller experiments.

7720 (UCID—17582) **Effects of beat-wave electron trapping on stimulated Raman and Thomson scattering.** Cohen, B.I.; Kaufman,

A.N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Sep 1977. Contract W-7405-ENG-48. 38p. Dep. NTIS, PC A03/MF A01.

The influence of electron trapping on a large-amplitude plasma oscillation driven by the nonlinear interaction of two electromagnetic waves (stimulated Raman scattering) is studied analytically and by means of numerical simulation. When the plasma oscillation is resonantly excited to sufficiently large amplitude and electron trapping occurs, there ensues considerable modification of the electron velocity distribution function. The stimulated scattering ceases to be a resonant three-wave process, but continues as induced scattering by resonant electrons (stimulated Thomson scattering). 5 figures.

7721 Axial heating of magnetically confined plasma with CO_2 lasers. Offenberger, A.A. (Culham Lab, Abingdon, Oxfs, Engl). *Can. J. Phys.;* **55**: No. 5, 412-418(1 Mar 1977).

The coupled electron-ion heating equations, neglecting losses, in a CO_2 laser heated solenoid are solved for a laser intensity varying with time as I=I$_0$/sup 2/3/. An analytical solution, without restriction on the ratio of electron-to-ion temperatures T/sub e/T/sub i/ is found, showing T/sub e/i/ varies as t/sup 2/3/. The heating wave which propagates along the solenoid is found to be supersonic having a velocity independent of time and varying as I$_0$/sup 3/5/. Low intensity heating is found to maximize T/sub i//T/sub e/ and minimize plasma length and laser energy requirements. The heating wave propagation is found to be consistent with an optical thickness of order unity in the heated plasma column. Considerations of electron-ion energy transfer, supersonic heating wave progagation, and laser beam trapping lead to an optimum laser intensity parameter I$_0$congruent2*10^{13} W cm^{-2}s/sup -2/3/. These results are pertinent to fusion experiments. 17 refs.

7722 Resistivity, heating and radial transport on the axis of the tokamak discharge. Siambis, J.G.; Stitzer, S.N. (Nav Res Lab, Washington, DC). *IEEE Trans. Plasma Sci.;* **PS-4**: No. 2, 134-143(Jun 1976).

Analytical and numerical results are presented on the resistivity, heating and radial transport of particles momentum and heat on and near the minor axis of the Tokamak discharge. The crucial role of impurities is emphasized. Asymptotically exact electromagnetics and classical fluid dynamics are utilized to obtain first the case of the straight infinite cylinder. Toroidal effects are then included at the level of the Pfirsch-Schluter theory. Analytical results from the complete model show the transport coefficients to be classical with enhanced values related to the presence of the impurity ions and the toroidal effects. Numerical results from a simpler simulation model are found to be in reasonable agreement with published experimental results from the ST-Tokamak. 34 refs.

7723 Third symposium on plasma heating in toroidal devices. Lectures and contributed papers. Sindoni, E. (ed.). Bologna; Editrice Compositori (1976). 480p. (CONF-760958—).

From 3. international symposium of plasma physics on heating in torodial devices; Varenna, Italy (6 Sep 1976).

Sixty-six lectures and papers are included in the proceedings. The topics generally cover various techniques for high-frequency and neutral beam injection heating. (MOW)

PLASMA DIAGNOSTICS

REFER ALSO TO CITATION(S) 7107

7724 (PPPL—1365) **Diagnostic problems of large tokamaks.** Young, K.M. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Aug 1977. Contract EY-76-C-02-3073. 27p. (CONF-760730—6). Dep. NTIS, PC A04/MF A01.

From 5. international conference on atomic physics; Berkeley, California, United States of America (USA) (26 Jul 1976).

The increase in scale of Tokamaks, together with the very large power input from auxiliary heating, lead to a requirement for new diagnostic techniques. The reference plasma parameters used in establishing this requirement for this review paper are those predicted for the operation of TFTR. The physics aspects of the diagnostic methods are described with particular inference on areas of interest to atomic physicists.

7725 (PPPL—1377) **Impurity measurements in PLT.** Dylla, H.F. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Sep 1977. Contract EY-76-C-02-3073. 31p. Dep. NTIS, PC A03/MF A01.

During the first eighteen months of PLT operation, measurements on impurity-related effects have been obtained using Thomson scattering, visible, vacuum ultra-violet and soft x-ray spectroscopy, mass spectrometry, bolometry, and surface analysis. A brief review is presented of these diagnostic techniques and the present characterization of the discharge cleaning process and impurity related effects in high power discharges.

7726 (UCRL—80058(Rev.1)) **Diagnostics systems developments and applications for laser fusion experiments.** Coleman, L.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Sep 1977. Contract W-7405-ENG-48. 18p. (CONF-770954—1). Dep. NTIS, PC A02/MF A01.

From 2. conference on hot plasma diagnostics; Kharkov, USSR (22 Sep 1977).

A variety of systems are required for adequate diagnostics of laser fusion experiments. Picosecond scale temporal measurements are typically made with ultrafast streak cameras. Visible and x-ray sensitive streak cameras with resolutions of 6 psec and 15 psec, respectively, and dynamic recording range in excess of 10^3 are in regular use on experiments at Livermore. The characteristics of these cameras and their applications to target experiment diagnostics are described. The development and testing of a prototype ultrafast framing system is discussed. Because of the need for "real time" data acquisition, analysis, and control systems, techniques for providing directly computer interfaced image data from streak and framing cameras and optical imaging systems are being developed. The status of these developments and the characteristics of the computer interfaced data and control systems on Argus and Shiva are summarized.

7727 (UCRL-Trans—11264) **Methods for determining the electron density of a laser plasma from x-ray spectra of multiply charged K ions.** Boiko, V.A.; Pikuz, S.A.; Faenov, A.Ya. 1977. Translation of Preprint No. 26. 44p. Dep. NTIS, PC A03/MF A01.

A description is given of present methods of determination of the electron density of laser plasma from x-ray line spectra of multiply charged K ions. The paper describes the body of experimental results and their comparative analysis, and the potentialities of various methods. The methods discussed are based on measurements of (1) the intensity ratio of the resonance and intercombination lines of [He] ions, (2) intensity ratio of two-electron satellites of the resonance doublet Ly/sub α/ of [H] ions, (3) intensity ratio of the fine splitting components of Ly/sub α/ of [H] ions in an optically thin plasma, and (4) Stark broadening of the spectral lines of [H] ions. (MOW)

PLASMA KINETICS - GENERAL

7728 (AD—650036) **International developments in controlled thermonuclear fusion.** Dougal, A.A. (Texas Univ., Austin (USA)). 27 Mar 1967. 9p. (AFOSR—67-0821). .

Basic processes and fundamental technological requirements of controlled thermonuclear fusion have been widely discussed. Briefly, they include: heating an ultrapture, low density deuterium and tritium plasma to superhigh temperatures; stably containing the extreme temperature plasma by magnetic fields for a duration adequate to fuse the nuclei; diminishing particle losses occurring through diffusion and instabilities to acceptable levels; gaining useful fusion products conveying energy sufficiently in excess of thermal and radiant energy losses; and, finally, converting the energy released to useful electric power. Recent progress has been encouraging. Numerous and diverse plasmas have been produced and improved understanding and experimental confirmation of stable magnetic containment have been obtained. Also, increased plasma density temperature, and containment times in a few experimental systems have been achieved. However, complex difficulties, such as new types of instabilities, raise formidable barriers to a workable reactor concept.

7729 (CONF-770242—(Absts.)) **Conference on atomic processes in high temperature plasmas: a topical conference of the American Physical Society Division of Plasma Physics.** (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 112p. Dep. NTIS, PC A06/MF A01.

From Conference on atomic processes in high temperature plasmas; Knoxville, Tennessee, USA (16 Feb 1977).

Abstracts are included for approximately 100 of the papers presented at the meeting. The following sessions were held at the conference: (1) electron ionization and excitation rates, (2) radiation from low density plasmas, (3) electron-ion cross sections and rates, (4) oscillator strengths and atomic structure, (5) spectroscopy and atomic structure, (6) astrophysical plasmas, (7) particle transport, (8) ion-atom cross sections and rates, (9) wall effects in laboratory plasmas, (10) spectroscopy and photoionization, and (11) radiation from high density plasmas. (MOW)

7730 (ERDA—77-73) **Atomic data needs for magnetic fusion energy. Report of an Ad Hoc Panel meeting, Knoxville, Tennessee, February 15, 1977.** (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Magnetic Fusion Energy). 1977. 19p. Dep. NTIS, PC A02/MF A01.

The Panel met in a one-day session to review progress on, and needs for, atomic data in the Magnetic Fusion Energy (MFE) Program. In particular, the 1974 report of the Subpanel on Atomic and Molecular Data presented in ERDA-39 (The 1974 Review of the Research Program) was examined to determine modifications, corrections, additions and deletions that are required to bring the

report up to date. The Section on Surface Interactions in the 1974 report was not discussed as it is not part of the Division of Magnetic Fusion Energy/Applied Plasma Physics (DMFE/APP) program. Similarly, the Subpanel Report on Nuclear Data was not discussed. The general comments and recommendations are included.

7731 **Fusion technology.** New York; Pergamon Press (1976). 941p. (EUR—5602; CONF-760631—).

From 9. symposium on fusion technology; Garmisch-Partenkirchen, German, Federal Republic of (F.R. Germany) (14 Jun 1976).

Abstracts for each of the 128 papers were entered into the data base. (MOW)

PLASMA KINETICS - THEORETICAL

7732 (LA—6615) **Photoionization cross sections and radiative recombination rate coefficients for positive ions of carbon and gold.** Barfield, W.D. (Los Alamos Scientific Lab., N.Mex. (USA)). Sep 1977. Contract W-7405-ENG-36. 24p. Dep. NTIS, PC A02/MF A01.

Partial photoionization cross sections based on a nonhydrogenic single-electron model that utilizes Dirac—Slater wave functions and all necessary multipoles have been computed for C III-VI and Au + 8, +16, +24, and +36 for n = 1 - 6 and 10, 0 less than or equal to l < n. By use of detailed balance, radiative recombination rate coefficients are obtained for seven temperatures in the range 10 eV - 3 keV from the photoionization cross sections. The cross sections are compared with those obtained by others using semiclassical (Kramers) and hydrogenic models. In most cases, the recombination rate coefficients (summed over subshells) are larger than those computed using hydrogenic photoionization cross sections, by as much as a factor 30 (Au + 8, n = 5, kT = 43 keV). Analytical fits are given for the rate coefficients summed over l and n. The results are applicable to ionization balance and ion transport calculations for fusion reactors and the solar corona.

7733 (ORNL/TM—6019) **Plasma simulation and modeling for ELMO bumpy torus reactor.** Uckan, N.A.; Hedrick, C.L. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 38p. Dep. NTIS, PC A04/MF A01.

A simple model (time-dependent deuterium-tritium point model) has been formulated to assess the energy balance in an ELMO Bumpy Torus Reactor (EBTR) plasma. The effects of the different scaling assumptions on EBTR performance and operating point have been analyzed. Although in the present EBT device (EBT-I) plasma transport seems to be governed largely by neoclassical processes, hypothesized anomalous transport losses are included in the plasma simulation model in addition to neoclassical and for classical transport in order to test the sensitivity of EBTR parameters. For the particular case studied, it is shown that the reference EBTR can accommodate anomalous losses one to two orders of magnitude greater than the present neoclassical losses at the operating point (steady state). Results are discussed.

7734 (ORO—2598-10) **Theory of waves, instabilities, and transport in thermonuclear plasmas. Progress report, 1 June 1976—1 December 1977.** (Tennessee Univ., Knoxville (USA). Dept. of Physics). 1977. Contract EY-76-S-05-2598. 6p. Dep. NTIS, PC A02/MF A01.

Results are reported in three theoretical areas, plasma heating by radio frequency wave, transport processes in the bumpy torus, and in the magnetohydrodynamic stability of toroidal plasmas. Linear electron cyclotron heating is found to be a very efficient method for heating tokamaks of moderate density. Linear heating is limited to densities such that the plasma frequency at resonance is less than the cyclotron frequency. At higher densities the nonlinear process of frequency doubling with a subsequent parametric decay can be used with high power sources. Some results on a model of Alfven wave heating are presented, useful for scaling laws for the extrapolation of data and prediction of the system behavior in large tokamaks. The work on transport processes in a bumpy torus has been carried to the point where extensive computer calculations are necessary, which will be carried out by the group at ORNL. The transport coefficients have a strong dependence on the ambipolar electric field and plasma collisionality. The work on MHD instabilities has continued. Results are presented for toroidal corrections for ideal MHD.

7735 (PPPL-EPRI—6) **Poloidal rotation damping on pure toroidal magnetic field lines.** Mostrom, M.A.; Boozer, A.H. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Sep 1977. Contract EY-76-C-02-3073. 35p. Dep. NTIS, PC A03/MF A01.

The damping rate of plasma poloidal rotation on pure toroidal magnetic field lines is evaluated. The results can be given in terms of an orthogonal electrical conductivity sigma/sub perpendicular/ or the return current J/sub perpendicular = σ prependicular to E perpendicular to/ acts to decrease the ambipolar electric field associated with the rotation. The results are applied to the tormac device where, in one version, the bulk plasma is penetrated only by toroidal magnetic field lines. In this case, the electric field associated with the rotation arises from the nonambipolar charge loss due to the toroidal drift carrying the sheath loss-cone distribution into the plasma.

7736 (UCRL—79600(Pt.2)) **Some highlights of theoretical and computational plasma physics.** McNamara, B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Aug 1977. Contract W-7405-ENG-48. 59p. Dep. NTIS, PC A04/MF A01.

The objectives of this report are to provide some insight into the basic models, to give some impression of the difficult nature of the equations, to show some of the present understanding of the nonlinear consequences of the equations, and to illustrate the remarks with computational studies. The aim of this plasma theory is to describe equiiibria, stability of the equilibria, and the transport of energy and particles out of the plasma. (MOW)

7737 (UCRL—79600(Pt.2)(Rev.1)) **Some highlights of theoretical and computational plasma physics.** McNamara, B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Aug 1977. Contract W-7405-ENG-48. 48p. Dep. NTIS, PC A03/MF A01.

The objectives of the selection are to provide some insight into the basic models, to give some impression of the difficult nature of the equations, to show some of the present understanding of the nonlinear consequences of the equations, and to illustrate the remarks with computational studies. The physical situations envisaged are always closely related to the Tokamaks or Mirror Machines described in the first pair of lectures. The aim of this plasma theory is to describe equilibria, stability of the equilibria, and the transport of energy and particles out of a plasma. These three topics separate naturally according to the time and space scales of the phenomena involved and the plasma models reflect this.

7738 (UWFDM—216) **POICOU: a point plasma code including profile effects for tokamak power reactors.** Lao, L. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Aug 1977. Contract EY-76-S-02-2272. 20p. Dep. NTIS, PC A02/MF A01.

A time independent point computer code for tokamak power reactors is reported which includes effects of different particle density and temperature profiles. The code is used to study the gas blanket power reactor by assuming it has a flat density profile and a bell-shaped temperature distribution. It was seen that while the average plasma density and temperature may remain the same compared with the one having both bell-shaped profiles, the thermal output can drop by a factor of as high as 25%. (MOW)

PLASMA PRODUCTION

7739 **Laser-heated solenoid fusion.** Vlases, G.C. (Mathematical Sciences Northwest, Inc., Bellevue, WA). *J. Energy;* **1**: No. 3, 189-195(1977).

Since the suggestion by Dawson, Hertzberg, and Kidder that high-energy CO_2 lasers could be used to heat magnetically confined plasma columns to thermonuclear temperatures, a great deal of theoretical and experimental work has been performed. In this paper we first review the experiments on the basic laser-plasma interaction phenomena, in which lasers with energies up to 1 kJ have been used to produce plasmas at n/sub e/ greater than 10^{18} and T/sub e/ greater than 200 eV. The second part reviews fusion reactor studies based on the laser solenoid.

7740 (UCRL-Trans—11250) **Analytical model for pellet heating by lasers.** Salvat, M.; Lengyel, L.I. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1975. Translation of German report No. IPP—4/136. 15p. Dep. NTIS, PC A02/MF A01.

Analytical solutions are presented for the expansion (and contraction) of laser-produced plasmas (with heat supply) and are discussed.

PLASMA INSTABILITIES

REFER ALSO TO CITATION(S) 7734, 7772

7741 (ORO—5260-1) **Effects of pressure anisotropy on the stability of the guiding center plasma. Progress report, September 15, 1976—December 14, 1977.** Vahala, G. (College of William and Mary, Williamsburg, Va. (USA)). 1977. Contract EY-76-S-05-5260. 26p. Dep. NTIS, PC A03/MF A01.

The stability analysis of nearly cylindrical magnetically confined plasma is generalized to include effects of pressure anisotropy in the guiding center model of Grad. The equilibrium and normal mode equations for helically symmetric plasmas are found and it is shown that these equations reduce to all previous diffuse profile bumpy theta pinch and helical calculations (in the appropriate limits). The equations presented are valid for arbitrary helical wave number k, arbitrary degree of helicity L and O(1) pressure anisotropy. It is shown that the "new" and "old" Scyllac orderings can be unified in a single calculation. Drift orbit diffusion induced by

turbulence acting on trapped electrons is shown to reduce and broaden the magnetic drift resonance and produce the dominant nonlinear saturation mechanism for the dissipative trapped electron instability. The fluctuation level obtained is consistent with present experimental observations. Analytic FCT equilibria have been found in cylindrical geometry. Ideal 3D incompressible MHD turbulence in cylindrical geometry shows that mean square turbulent velocity fields [v vector²] not equal to 0 for virtually all initial conditions (including qiescent ones), except for a state of extremal helicity. A conjecture, based on the inverse cascade of magnetic helicity, is put forward to explain J.B. Taylor's hypothesis for reversed field pinches.

7742 (PPPL—1367) **Effect of circulating ion resonances and impurities on the dissipative trapped-ion instability.** Marchand, R. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Aug 1977. Contract EY-76-C-02-3073. 38p. Dep. NTIS, PC A03/MF A01.

Trapped-ion instabilities associated with both electron and ion diamagnetic branches are studied. In particular, the influence of circulating ion Landau resonances and impurities are determined. These effects are studied in the local limit and have been implemented in a computer code used to calculate the relevant mode frequencies.

7743 (PPPL—1369) **Nonlinear saturation of the trapped-ion mode by mode coupling in two dimensions.** Cohen, B.I.; Tang, W.M. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Aug 1977. Contract EY-76-C-02-3073;W-7405-ENG-48. 50p. Dep. NTIS, PC A03/MF A01.

A study of the nonlinear saturation by mode coupling of the dissipative trapped-ion mode is presented in which both radial and poloidal variations are considered. The saturation mechanism consists of the nonlinear coupling via E x B convection of energy from linearly unstable modes to stable modes. Stabilization is provided at short poloidal wavelengths by Landau damping from trapped and circulating ions, at short radial wavelengths by effects associated with the finite ion banana excursions and at long wavelengths by ion collisions. A one-dimensional, nonlinear partial differential equation for the electrostatic potential derived in earlier work is extended to two dimensions and to third order in amplitude. Included systematically are kinetic effects, e.g., Landau damping and its spatial dependence due to magnetic shear. The stability and accessibility of equilibria are considered in detail for cases far from as well as close to marginal stability. In the first case three-wave interactions are found to be important when the spectrum of unstable modes is sufficiently narrow. In the latter case, it is found that for a single unstable mode, a four-wave interaction can provide the dominant saturation mechanism. Cross-field transport is calculated, and the scaling of results is considered for tokamak parameters.

7744 (PPPL—1373) **Low-frequency microinstabilities in the PLT Tokamak.** Mazzucato, E. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Sep 1977. Contract EY-76-C-02-3073. 26p. Dep. NTIS, PC A03/MF A01.

A turbulence with wavelengths in the range 2 to 0.2 cm and with a spectrum in the range of frequencies of drift waves has been observed in the PLT discharge with scattering of microwaves. The total density fluctuation was n tilde/sub e//anti n/sub e/ approximately equal to 5 x 10^{-3} - 10^{-2}. It is estimated that this turbulence can cause an anomalous transport much larger than that predicted by the neoclassical theory. As the PLT discharge developed a central minimum of the electron temperature, an increase of the turbulence level was observed with a very strong poloidal localization on the outside of the plasma torus.

7745 (PPPL—1376) **Stability and magnetic tearing of finite-β modified drift waves.** Chen, L.; Hsu, J.; Kaw, P.K.; Rutherford, P.H. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Oct 1977. Contract EY-76-C-02-3073. 24p. Dep. NTIS, PC A02/MF A01.

A new simplified approach to the analysis of radial eigenmodes of finite-β modified drift waves in a sheared magnetic field is described. Applying this approach to the universal drift mode, one recovers, for the lowest (n = 0) radial eigenmode, the previous result that finite-β effects are stabilizing. For the next (n = 1) radial eigenmode, however, one finds that finite-β effects further destabilize the mode. Moreover, the corresponding mode structure exhibits nonzero radial (tearing) magnetic perturbations around the mode-rational surface. The consequences of a structure of microscopic magnetic islands, created in this way, for plasma transport are also briefly discussed.

7746 **Excitation of a parametric decay instability by an electromagnetic wave at twice the upper hybrid frequency.** Piejak, R.B. Tucson, AZ; Univ. of Arizona (1977). 92p. University Microfilms Order No. 77-18,661.

Thesis (Ph. D.).

A fluid theory is written which describes the parametric instability of a pair of electrostatic waves by a large amplitude electromagnetic wave propagating along a D.C. magnetic field in a warm homogeneous plasma. It is assumed that the decay waves oscillate at a frequency near the plasma frequency, and that the electromagnetic pump wave oscillates at twice the plasma frequency. The threshold voltage of the pump wave, necessary to excite the instability, and the growth rate of the decay wave pair is found. An experimental system has been designed and built to observe the instability. A 50 KW pulsed magnetron at 2.8 GHz is the source of the pump wave. The pump wave propagates along a triplate waveguide, which is immersed in an argon plasma. Two distinctly different instabilities near the plasma frequency are received on a spade-shaped antenna inside the plasma. In one case, two separate decay waves are observed. In the other case, the frequencies of the decay waves are so near to each other, that only one spectrum of waves is observed. It is believed that this is the first time these instabilities have been seen experimentally.

PLASMA WAVE PHENOMENA

REFER ALSO TO CITATION(S) 7720, 7743

7747 (PPPL—1372) **Landau damping of low and high power slow electrostatic waves.** Paoloni, F.J.; Motley, R.W.; Hooke, W.M.; Bernabei, S. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Sep 1977. Contract EY-76-C-02-3073. 15p. Dep. NTIS, PC A02/MF A01.

Waves were excited in a warm plasma at frequencies above the lower hybrid frequency and have measured their damping characteristics under a variety of conditions. Strong wave absorption was measured if ω/k/sub "/ less than or equal to 3 v/sub e/, in agreement with the predictions of linear Landau damping. At a certain critical power level, consistent with the power required to flatten the velocity distribution, the absorption disappears. Above this level evidence was obtained for the appearance of an enhanced electron tail between 80—250 eV, in and above the energy range where Landau damping should occur.

7748 (UCID—17577) **Differential equation for Alfven ion cyclotron waves in finite-length plasma.** Watson, D.C.; Fateman, R.J.; Baldwin, D.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Sep 1977. Contract W-7405-ENG-48. 25p. Dep. NTIS, PC A02/MF A01.

One finds the fourth-order differential equation describing an Alfven-ion-cyclotron wave propagating along a magnetic field of varying intensity. The equation is self-adjoint and possesses non-trivial turning points. The final form of the equation is checked using MACSYMA, a system for performing algebra on a computer.

7749 **Locally excited magnetohydrodynamic waves in a uniform cylindrical plasma waveguide.** Sy, W.N.C. (Flinders Univ of South Aust, Bedford Park). *J. Plasma Phys.;* **17**: 281-300(Apr 1977).

The guided modes of L.C. Woods' magnetohydrodynamic waveguide for a uniform, cylindrical plasma are shown to satisfy a homogeneous wave equation whose differential operator is the product of eight Helmholtz operators. The propagation constants of the Helmholtz operators are the characteristic roots of an 8*8 matrix which is derived and written down explicitly. This reformulated theory is extended to include localized sources which excite the guided modes. For the case of MHD waves excited by an azimuthally symmetric current source in a resistive, pressureless, inviscid, fully ionized plasma, a detailed solution is obtained which is in good qualitative agreement with experiments. 10 refs.

7750 **Magnetic dynamo action in two-dimensional turbulent magnetohydrodynamics.** Fyfe, D.; Joyce, G.; Montgomery, D. (Univ of Iowa, Iowa City). *J. Plasma Phys.;* **17**: 317-335(Apr 1977).

Two-dimensional magnetohydrodynamic turbulence is explored by means of numerical simulation. Previous analytical theory, based on non-dissipative constants of the motion in a truncated Fourier representation is verified by following the evolution of highly non-equilibrium initial conditions numerically. Dynamo action (conversion of a significant fraction of turbulent kinetic energy into long-wavelength magnetic field energy) is observed. It is conjectured that in the presence of dissipation and external forcing, a dual cascade will be observed for zero-helicity situations. Energy will cascade to higher wavenumbers simultaneously with a cascade of mean square vector potential to lower wavenumbers. Equipartition of kinetic and magnetic energies is expected at the highest wavenumbers in the system. 24 refs.

7751 **Nonlinear effects caused by the propagation of large amplitude electrostatic waves in a plasma.** Bitter, M. (Ecole Polytechnique Federale, Lausanne, Switzerland). *Z. Angew. Math. Phys.;* **26**: 649-655(25 Sep 1975).

Attention is given to the propagation of large-amplitude electrostatic waves which have been excited by means of an interaction of an electron beam with a plasma within a resonance cavity. The excitation method used makes it possible to select a single wave by tuning the cavity to the desired wavelength. A stationary argon

plasma which is produced in a hot-cathode glow discharge is employed in the experiments. Radially and axially movable Langmuir probes are used in the investigation. Nonlinear effects due to particle trapping are considered.

FUSION POWER PLANTS

7752 (ORNL/TM—5985) **Proposal for a major modification to the ISX tokamak to study equilibrium and stability of externally heated high β plasmas in noncircular geometry.** Swain, D.W.; Smith, T.E.; Sigmar, D.J.; Murakami, M. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 37p. Dep. NTIS, PC A03/MF A01.

The eventual use of tokamaks as economical fusion power generators will require the confinement of plasmas with values of β greater than or equal to 5%. The ISX tokamak at Oak Ridge National Laboratory can be modified to study the equilibrium, stability, and transport of a plasma with β in the 3-5% range. This can be achieved by adding up to 3 MW of neutral beam injection power on the machine and by replacing the vacuum chamber and poloidal field coils. The design, cost, and schedule for the modification are covered in this proposal, in addition to the reasons for performing these experiments.

7753 (UCID—17568) **Cost estimate for electrostatically plugged cusp reactor.** Dolan, T.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Aug 1977. Contract W-7405-ENG-48. 21p. Dep. NTIS, PC A02/MF A01.

A preliminary design of an electrostatically plugged cusp reactor was presented in (UCRL-52142(1976)). The capital costs of the various components of this reactor are estimated and totaled for two different blanket configurations: one having an energy multiplication factor M = 1.2, and the other having M = 1.68. The unoptimized direct capital costs for these cases are found to be about 1400 and 950 $/kWe, respectively.

7754 **Future with fusion power.** Hirschfeld, F. *Mech. Eng.;* **99**: No. 4, 22-31(Apr 1977).

This article reviews several current approaches to the development of nuclear fusion power sources by the year 2000. First mentioned is the only project to develop a nonpolluting, radiation-free source by using only natural and nonradioactive isotopes (nuclei of deuterium, helium 3 and boron) as "advanced" fuels. This system will also be capable of direct conversion of the released energy into electricity. Next described is the PACER concept, in which thermonuclear burning of deuterium occurs in fusion explosion taking place underground (e.g., in a salt dome). The released energy is absorbed in high-pressure steam which is then piped to a surface heat exchanger to provide steam for a turbogenerator. After filtration, the steam is returned. The PACER system also produces fissionable fuel. The balance of the article reviews three "magnetic fusion" approaches. Tokamak, mirror and theta pinch systems utilize magnetic fields to confine a plasma for either pulsed or steady-state operation. The tokamak and theta pinch are toroidal in shape, while the mirror can be thought of as a magnetic field configuration of roughly tubular shape that confines the plasma by means of higher fields at the ends than at its center. The tokamak approach accounts for about 65 percent of the magnetic fusion research and development, while theta pinches and mirrors represent about 15 percent each. Refs.

PHYSICS AND BLANKET ENGINEERING

REFER ALSO TO CITATION(S) 7768

7755 (PPPL—1370) **Neutronic calculation and cross section sensitivity analysis of the Livermore mirror fusion/fission hybrid reactor blanket.** Ku, L.P.; Price, W.G. Jr. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Aug 1977. Contract EY-76-C-02-3073. 34p. Dep. NTIS, PC A03/MF A01.

The neutronic calculation for the Livermore mirror fusion/fission hybrid reactor blanket was performed using the PPPL cross section library. Significant differences were found in the tritium breeding and plutonium production in comparison to the results of the LLL calculation. The cross section sensitivity study for tritium breeding indicates that the response is sensitive to the cross section of ^{238}U in the neighborhood of 14 MeV and 1 MeV. The response is also sensitive to the cross sections of iron in the vicinity of 14 MeV near the first wall. Neutron transport in the resonance region is not important in this reactor model.

7756 **Computer simulation of radiation transport and wall loading in fusion reactors.** Grammel, S.J. Ann Arbor, MI; Univ. of Michigan (1977). 251p. University Microfilms Order No. 77-18,010. Thesis (Ph. D.).

A system of radiation transport codes has been developed which models in two spatial dimensions the interaction within a CTR device between the plasma, the radiation emitted by the plasma, and the device wall geometry to determine the angular radiation flux incident upon the wall. The types of radiation considered are neutrons, bremsstrahlung, and synchrotron (cyclotron) radiation. In the initial phases of this study, the analysis and coding required the wall geometry to be specifiable analytically. As the study progressed, however, it became possible to alter the analysis so as to allow almost totally arbitrary wall geometries. Furthermore, the analysis was then expanded to allow the investigation of spectral variations in the wall loading. In the final stages of this study the synchrotron radiation analysis in arbitrary two-dimensional geometry has been altered to allow the computation of the effects of specular reflection from the wall material. This capability was originally available for bremsstrahlung in the restricted (analytic wall) calculation, but had to be dropped when the geometry was first allowed to become arbitrary. The extension of these analyses to three dimensions has been accomplished in a preliminary sense; i.e., both the 3-D neutron and bremsstrahlung analyses have been developed and coded, and are capable of producing valid numbers.

MAGNET COILS AND FIELDS

REFER ALSO TO CITATION(S) 7771

7757 (BNL—23083) **Magnet system for catalyzed D-D and D-He^3 reactors.** Usher, J.L.; Powell, J.R.; Hsieh, S.Y. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-03-0016. 13p. (CONF-770644—8). Dep. NTIS, PC A02/MF A01.

From EPRI review meeting on advanced fuel fusion; Chicago, Illinois, United States of America (USA) (27 Jun 1977).

A new concept for toroidal field magnets, called the DEALS (Demountable Externally Anchored Low Stress) magnet systems, has been conceived and developed for advanced fuel reactors. This concept should result in substantial cost reductions for toroidal magnets. In addition, the conductor stress is relatively low and compressive in nature, which is very important if brittle Nb_3Sn conductors are to be successfully used, since advanced fuel Tokamak reactors require Nb_3Sn conductor if reasonable power densities are to be achieved. A final very important benefit of the DEALS magnet system is demountability. Failed magnet segments can probably be replaced fairly rapidly (i.e., in approximately a month) without requiring movement and/or dissassembly of the blanket/shield regions and poloidal coils. Due to the high degree of noncircularity present in the plasmas of the low-β Tokamak reactor designs which are detailed in this report, a system of poloidal field coils is necessitated to provide both shape and positional stability. In addition, the uncertainty regarding the accessibility of the high-β regimes discussed may also necessitate extensive poloidal field systems. Volt second requirements are such that they must be alleviated also by this poloidal field system.

7758 (CONF-770842—6) **Design of force-cooled conductors for large fusion magnets.** Dresner, L.; Lue, J.W. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 7p. Dep. NTIS, PC A02/MF A01.

From 6. international conference on magnet technology; Bratislava, Czechoslovakia (29 Aug 1977).

One type of conductor under consideration for tokamak toroidal field (TF) magnets is a cable-in-conduit cooled by supercritical helium in forced convection. The main problem is designing such force-cooled conductors (fcc) is to maintain adequate stability while keeping the pumping power tolerably low. The transit time of the helium through a coil is many minutes. Since recovery of the conductor from a thermomechanical perturbation takes on the order of tens of milliseconds, for purposes of calculation, the inventory of helium available to promote recovery is finite. This means that a large enough perturbation will quench the conductor. We can then judge the stability of a fcc by the maximum perturbation of some specified type against which the conductor is stable, i.e., can still return to the superconducting state. The simplest type of perturbation is a sudden, uniform heat input over the entire length of the conductor. The maximum, sudden, uniform heat input per unit volume of metal ΔH is called the "stability margin."

7759 (COO—2218-80) **Reversed field decay times.** Morse, E.C. (Illinois Univ., Urbana (USA)). 11 Jan 1977. Contract EY-76-S-02-2218. 5p. Dep. NTIS, PC A02/MF A01.

A two-fluid equilibrium plasma model with electron-ion drag terms taken from the Spitzer coefficients is used in the analysis. An equilibrium cold electron background is assumed to exist which balances the electrical charge of the rotating ion ring. The ions can be assumed to have a directed velocity which is on the order of their mean thermal velocity.

7760 (PPPL—1353) **Pure tension shape of a thick torus.** Weissenburger, D.W.; Christensen, U.R.; Bialek, J. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Jul 1977. Contract EY-76-C-02-3073. 23p. Dep. NTIS, PC A02/MF A01.

This report discusses the forces on an ideal toroidal coil system. It is demonstrated that the total vertical force on the top half of both a thin-shell torus and a thick torus depends only on the inner and outer major radii at the midplane. The total vertical force is divided in half to find the pure tension magnitude from which the shape of the pure tension curve can then be determined. A convenient method of solution is presented with several example curves for different coil thicknesses.

7761 (UCRL—13717) **Production of multifilamentary Nb_3Sn composites incorporating a high tin bronze.** Petrovich, A.; Zeithlin, B.A.; Walker, M.S. (Intermagnetics General Corp., Guilderland, N.Y. (USA)). 1977. Contract W-7405-ENG-48-1695603. 104p. Dep. NTIS, PC A06/MF A01.

The economics and processing methods have been examined for the fabrication of multifilamentary Nb_3Sn using a high tin bronze reactive matrix. Four conductor configurations utilizing the high tin bronze were compared with a conventional Cu-13 wt % Sn bronze. The most promising of these designs is potentially 40% lower in cost per ampere meter than the conventional composite. Large hydrostatic extrusion facilities, which are required for the high tin processing, are not presently available in this country but can be made by conversion of conventional presses. They exist in Europe. Experiments were conducted to investigate the applicability of hydrostatic extrusion, and billet components were successfully prepared using the hydrostatic extrusion technique. We have concluded that the economics, availability of facilities and initial fabrication results are favorable for this type of conductor and that the next stage in this program of scale up to extrusion and drawing of 2″ to 3″ diameter composite billets should be undertaken.

7762 **Interaction and protection of superconducting poloidal field coils and toroidal field coils in a tokamak experimental power reactor.** Yeh, H.T.; Lue, J.W. (Oak Ridge Natl Lab, Tenn). *Nucl. Technol.;* **33**: No. 2, 150-160(1977).

The protection problems of superconducting coils in a large tokamak device are delineated. Effects of the plasma discharge on the first wall, the induced voltage, and the temperature rise during the quench of a superconducting coil, as well as the mechanical load on coils due to their mutual interaction under normal or fault conditions, have been studied. Various design choices and protection schemes are used to ensure the integrity of the coils during quench. For the Oak Ridge Experimental Power Reactor design, a scheme of connecting symmetrically located toroidal field coils in groups isolates and discharges the fault coil only, giving satisfactory results.

POWER SUPPLIES AND CIRCUITRY

7763 (SAND—77-6016) **Control of the shape of high-current, high-voltage pulses generated by an artificial line.** Pivovar, L.I.; Taller, E.G. 1973. Translation by P. Newman from pp 57-58 of KHFTI—73-20. 5p. Dep. NTIS, PC A02/MF A01.

Several devices used in plasma physics, accelerator technology, etc., are supplied by current and voltage pulses of rectangular shape. When the load is variable or nonlinear, circuits containing active and passive loops incorporating a time delay are used to obtain the required pulse shape. These circuits are so expensive and time-consuming to design and develop, that it is desirable to develop a way to model them on a computer. Calculations necessarily include some simplifications, since some parameters can only be determined precisely by physical measurements on the finished device. The solution is described. (MOW)

FUEL SYSTEMS

REFER ALSO TO CITATION(S) 7770

7764 (ORNL/TM—5897) **Solid hydrogen pellet injection into the ORMAK Tokamak.** Foster, C.A.; Colchin, R.J.; Milora, S.L.; Kim, K.; Turnbull, R.J. (Oak Ridge National Lab., Tenn. (USA)). Jun 1977. Contract W-7405-ENG-26. 26p. Dep. NTIS, PC A03/MF A01.

Solid hydrogen spheres were injected into the ORMAK tokamak as a test of pellet refueling for tokamak fusion reactors. Pellets 70 μm and 210 μm in diameter were injected with speeds of 91 m/sec and 100 m/sec, respectively. Each of the 210-μm pellets added about 1% to the number of particles contained in the plasma. Excited neutrals, ablated from these hydrogen spheres, emitted light which was monitored either by a photomultiplier or by a high speed framing camera. From these light signals it was possible to measure pellet lifetimes, ablation rates, and the spatial distribution of hydrogen atoms in the ablation clouds. The average measured lifetime of the 70-μm pellets was 422 μsec, and the 210-μm spheres lasted 880 μsec under bombardment by the plasma. These lifetimes and measured ablation rates are in good agreement with a theoretical model which takes into account shielding of plasma electrons by hydrogen atoms ablated from spherical hydrogen ice.

7765 (PPPL—1368) **Critical impurity concentrations for ignition of catalyzed-deuterium fusion plasmas.** Jensen, R.V.; Jassby, D.L.; Post, D.E. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Sep 1977. Contract EY-76-C-02-3073. 12p. Dep. NTIS, PC A02/MF A01.

The maximum concentrations f/sub zc/ of various impurity species that permit ignition of catalyzed-deuterium fusion plasmas have been calculated. If cyclotron radiation is negligible, the values of f/sub zc/ at 35 keV, where the fusion power density is maximum, are approximately one-fifth of the values allowed for D-T ignited plasmas at 14 keV. For any impurity species, the allowed f/sub zc/ decreases nearly linearly with increasing cyclotron radiation loss.

7766 (UCID—17559) **Plasma production and flow in ion beams.** Hooper, E.B. Jr.; Willmann, P.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Aug 1977. Contract W-7405-ENG-48. 29p. Dep. NTIS, PC A03/MF A01.

Space charge neutralization of ion beams results from plasma generated by the beam. The two dimensional flow of plasma to walls surrounding a beam is analyzed to provide spatial distributions. Negative ion beams receive particular attention; the results are applied to electron control in beams subject to post-acceleration.

7767 (UCRL—79570) **Evaluation of beam-line components for use in a large neutral-beam injector.** Fink, J.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Aug 1977. Contract W-7405-ENG-48. 7p. (CONF-770940—2). Dep. NTIS, PC A03/MF A01.

From Symposium on the production and neutralization of negative hydrogen ions and beams; Upton, New York, USA (26 Sep 1977).

A conceptual model of a neutral-beam injector was used to examine the effect of beam-line components on reactor performance. Criteria were established to optimize a reactor's reliability and minimize its cost.

POWER CONVERSION SYSTEMS

7768 **Radioactivity calculations in fusion reactors.** Sung, T.Y. Madison, WI; Univ. of Wisconsin (1976). 158p. University Microfilms Order No. 77-8817.

Thesis (Ph. D.).

The calculations of neutron induced radioactivity and afterheat of blankets and shields are essential parts in fusion reactor designs. As the progress in fusion reactor designs is made, the need for more accurate and consistent activity results becomes more urgent. The activity calculations are needed not only for the choice of blanket and shield materials, but also for evaluating environmental impact and radiological hazards. Also, the results can be applied to some related problems such as lifetime of the reactor, replacement interval for the first wall, maintenance and repair of blanket, safety analysis, reprocessing of blanket material, and cost estimation. The activities of fusion reactors are illustrated for UWMAK-I and Gas-Carried Li_2O Blanket, and activity calculations for the Tokamak Engineering Test Reactor (TETR) are discussed in detail and compared with previous work.

INERTIAL CONFINEMENT SYSTEMS

REFER ALSO TO CITATION(S) 7207, 7208, 7210, 7230, 7233, 7287, 7726

7769 (LA-UR—77-1923) **Alignment system for large high-power CO_2 laser fusion systems.** Bausman, M.D.; Liberman, I.; Manning, J.P.; Singer, S. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 11p. (CONF-770868—1). MF A01.

From 21. annual technical symposium of the Society of Photo-Optical Instrumentation; San Diego, California, USA (22 Aug 1977).

Aligning a pulsed CO_2 laser fusion system involves control systems which insure that the centers of beams follow a prescribed path to within 1 mm, that the pointing of the beams is correct to approximately 20 microradians, and that focal spot at the location of the experimental fusion target be placed to accuracies of 10 to 20 micrometers laterally and approximately 50 micrometers axially. These alignments are accomplished by a variety of sensing techniques which include thermal pinholes and quadrant detectors, Seebeck effect silicon detectors, and imaging autocollimating Hartmann test procedures employing ir vidicon systems.

7770 (NRL-MR—3574) **Some Rayleigh—Taylor stabilizing mechanisms in thin laser targets.** Felber, F.S.; Bodner, S.E. (Naval Research Lab., Washington, D.C. (USA)). Aug 1977. Contract ES-77-A-01-6021. 16p. Dep. NTIS, PC A02/MF A01.

Several mechanisms that reduce the linear growth rate and severity of Rayleigh-Taylor instability in thin, inhomogeneous laser targets are discussed.

7771 (ORO—5000-3) **Target chamber magnetic fields in pellet fusion reactors.** Tidman, D.A. (Maryland Univ., College Park (USA). Inst. for Physical Science and Technology). 20 Jan 1977. Contract EY-76-S-05-5000. 16p. Dep. NTIS, PC A02/MF A01.

Stray magnetic fields are expected to be generated by various mechanisms following a fusion pellet explosion in a reactor target chamber. These fields, which would be partially trapped in the chamber between explosions, may present a complication for the accurate aiming of focussed low atomic weight ion beams on to a target pellet. Multi-GeV heavy ion beams in moderate charge states have the advantage of being less sensitive to this aspect of the pellet environment.

7772 (ORO—5000-4) **Stability of high energy focused ion beams for pellet fusion in target chamber.** Sudan, R.N.; Tidman, D.A. (Cornell Univ., Ithaca, N.Y. (USA). Lab. of Plasma Studies; Maryland Univ., College Park (USA). Inst. for Physical Science and Technology). Oct 1976. Contract EY-76-S-05-5000. 13p. Dep. NTIS, PC A02/MF A01.

The possible development of kink instabilities in energetic heavy ion beams focused on to a target for pellet fusion is discussed for the case in which the background medium is a plasma.

7773 (SAND—77-2017C) **Neutron production from advanced RDB fusion targets.** Chang, J.; Leeper, R.J.; Widner, M.M.; Farnsworth, A.V. Jr.; Prevender, T.S. (Sandia Labs., Albuquerque, N.Mex. (USA)). Mar 1977. Contract EY-76-C-04-0789. 16p. (CONF-771035—1). Dep. NTIS, PC A02/MF A01.

From 2. international topical conference; Ithaca, New York, USA (3 Oct 1977).

Experiments have been performed in which plastic shells, containing a CD_2 fuel wire, were irradiated and imploded by a single beam from the Rehyd REB accelerator (1 MeV, 250 kA, 100 nsec). The fuel wire is pre-exploded by beam prepulse, providing preheat and magnetic fields in the fuel which permit high fuel temperatures upon implosion. Initial results indicate that greater than 10^6 neutrons, of energy 2.5 +- 0.2 MeV, were produced during the last 30 nsec of the voltage pulse, consistent with the expected implosion time. Additional "null" shots with portions of the target cut away and/or without prepulse did not produce such neutrons. These initial data suggest the origin of the neutrons to be thermonuclear.

7774 (UCRL—79285) **SHIVA laser: nearing completion.** Glaze, J.A.; Godwin, R.O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 May 1977. Contract W-7405-ENG-48. 11p. (CONF-770434—7). Dep. NTIS, PC A02/MF A01.

From SPIE x-ray imaging symposium; Reston, Virginia, United States of America (USA) (20 Apr 1977).

Construction of the Shiva laser system is nearing completion. This laser will be operating in fall 1977 and will produce over 20 terawatts of focusable power in a subnanosecond pulse. Fusion experiments will begin early in 1978. It is anticipated that thermonuclear energy release equal to one percent that of the incident light energy will be achieved with sub-millimeter deuterium-tritium targets. From other experiments densities in excess of a thousand times that of liquid are also expected.

7775 (UCRL—80004) **Optical engineering problems associated with construction of the Shiva Laser Fusion Facility.** Godwin, R.O.; Bliss, E.S.; Glaze, J.A.; O'Neal, W.C.; Patton, H.G.; Summers, M.A.; Wallerstein, E.P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Aug 1977. Contract W-7405-ENG-48. 6p. (CONF-770844—5). Dep. NTIS, PC A02/MF A01.

From International optical computing conference; San Diego, California, USA (25 Aug 1977).

The Shiva laser system is part of a new 20 terawatt laser facility at Lawrence Livermore Laboratory. The system contains more than $5,000,000 worth of optics. This paper discusses the various optical components, typical component quantities and specification, and the problem of laser damage to components.

7776 (Y/DA—7258) **LASL laser mirror program. Excerpts from Y-12 development division technical progress reports. Period ending June 1, 1977.** Thompson, C.H. (comp.). (Oak Ridge Y-12 Plant, Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 58p. Dep. NTIS, PC A04/MF A01.

Finite-element deflection analyses have been performed on various mounting schemes for nonaxisymmetric key-shaped mirrors. Various mounting imperfections have been assumed and their results on mirror warpage calculated.

COMPONENT DEVELOPMENT AND TESTING

REFER ALSO TO CITATION(S) 7177, 7214, 7626, 7756

7777 (BNWL—2390) **Neutron irradiation effects on carbon and graphite cloths and fibers.** Gray, W.J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1977. Contract EY-76-C-06-1830. 51p. Dep. NTIS, PC A04/MF A01.

A series of cloth and fiber samples were irradiated to fluences of 3.5, 7.3, and 10 x 10^{21} cm^{-2} at 470°C. Dimensional changes of the fibers in the radial direction ranged from -19% to +33% and in the axial direction from -18% to -27%, roughly ten times greater than dimensional changes found for typical nuclear graphites. Despite these large dimensional changes, all but one of the 2-dimensional cloths remained essentially unchanged in overall physical appearance. The 3-dimensional cloths, on the other hand, deteriorated apparently because these types of weaves were less able to accommodate the large axial fiber shrinkages.

7778 (COO—2456-47) **Shock-tube study of fusion plasma-wall interactions.** Gross, R.A.; Tien, J.K.; Jensen, B.; Panayotou, N.F.; Feinberg, B. (Columbia Univ., New York (USA). Plasma Physics Lab.). 1977. Contract EY-76-S-02-2456. 7p. (CONF-770725—2). Dep. NTIS, PC A02/MF A01.

From 11. international symposium on shock tubes and waves; Seattle, Washington, USA (11 Jul 1977).

Theoretical and experimental studies have been made of phenomena which occur when a hot (T_i approximately equal to 6 x 10^6 °K), dense (n approximately equal to 10^{16} cm^{-3}), deuterium plasma containing a transverse magnetic field is brought into sudden contact with a cold metal wall. These studies are motivated by the need to understand plasma and metallurgical conditions at the first-wall of a fusion reactor. Experiments were carried out in the Columbia high energy electromagnetic shock tube. Computational simulation was used to investigate the detailed physics of the fusion plasma boundary layer which develops at the wall. The rate of energy transfer from the plasma to the wall was calculated and conditions under which surface melting occurs are estimated. Experimental measurements of plasma-wall heat transfer rates up to 3 x 10^5 watts/cm^2 were obtained and agreement with computed values are good. Fusion reactor first-wall materials have been exposed to 6.0 x 10^{21} eV cm^{-2} (1,000 shots) of deuterium plasma bombardment. Scanning electron micrograph photographs show preferential erosion at grain boundaries, formation of deuterium surface blisters, and evidence of local surface melting. Some cracking is observed along grain boundaries, and a decrease in tensile ductiity is measured.

7779 (COO—2802-4) **Graphite curtain vacuum outgassing and heat transfer. Final report.** Fivel, H.J.; Lang, G.P.; Kipp, H.W. (McDonnell Douglas Astronautics Co., St. Louis, Mo. (USA)). Dec 1976. Contract EY-76-C-02-2802. 104p. Dep. NTIS, PC A06/MF A01.

Thermal conductivity of a bundle of high conductivity graphite fibers (T-50) was measured as a function of temperature, density and fiber orientation at pressures of 10^{-4} to 10^{-5} torr. All 3 variables had a significant influence on thermal conductivity. The highest conductivity fiber bundle tested had a conductivity significantly less than dense, bulk nuclear grade graphite. The incorporation of heat pipes into a graphite spectral shaper will permit a 2-fold thicker shaper. Heat pipes not only increase the transport of heat within the spectral shaper but can increase heat transfer at the shaper-first wall interface and potentially serve as a means of attaching shaper modules to the first wall. A heat pipe using a liquid metal working fluid was fabricated and tested in magnetic fields of 1 and 2 Tesla. Liquid metal heat pipes can be used in a magnetic field of at least up to 2 Tesla. Much more work needs to be done to establish the capabilities for high performance heat pipes when used in magnetic fields. Four different types of graphite fibers were exposed in EBR-II to a neutron fluence of 3.5 x 10^{21} cm^{-2} EFF at 470°C. Large axial shrinkages of 6.6 to 8.6% resulted.

7780 (ORNL—5323) **Magnetic fusion energy materials technology program annual progress report for period ending June 30, 1977.** Scott, J.L. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 127p. Dep. NTIS, PC A05/MF A01.

The objectives of the Magnetic Fusion Energy (MFE) Materials Technology Program, which is described in this report, are to continue to solve the materials problems of the Fusion Energy Division of ORNL and to meet needs of the national MFE program, directed by the ERDA Division of Magnetic Fusion Energy (DMFE). This work is a continuation of the program described in previous annual progress reports. The principal areas of work include radiation effects, compatibility studies, materials studies related to the plasma-materials interaction, materials engineering, radiation behavior of superconducting magnet insulation, and mechanical properties of superconducting composites. The level of effort and schedules are consistent with Logic II of the DMFE Program Plan.

7781 (SAND—77-8669) **Isotope effect in the pumping of hydrogen by titanium thin films.** Malinowski, M.E. (Sandia Labs., Livermore, Calif. (USA)). Aug 1977. Contract EY-76-C-04-0789. 16p. Dep. NTIS, PC A02/MF A01.

The hydrogen and deuterium pumping speeds of 1000 A thick titanium films deposited at 300°K and approximately 3A s^{-1} and reacted at approximately 20 mtorr and approximately 300°K are approximately constant for H (or D)/Ti loading ratios between 0.3

and 1.3 and are different for each isotope. For deuterium the pumping speed is approximately 0.13 l s^{-1} cm^{-2}, while for hydrogen the speed is essentially $\sqrt{2}$ times the deuterium speed, i.e., approximately 0.18 l s^{-1} cm^{-2}. Pumping speed data taken at approximately 5 mtorr indicate that agreement of the isotope data with a surface-sticking limited model requires a pressure-dependent, hydrogen isotope-independent sticking coefficient.

7782 (USGS—1005, pp 12-21) **Fusion power and the potential lithium requirement.** Bogart, S.L. (Energy Research and Development Administration, Washington, DC). 1976.

From Symposium on United States lithium resources and requirements by the year 2000; Lakewood, Colorado, United States of America (USA) (22 Jan 1976).

In Lithium resources and requirements by the year 2000.

The basic properties of the fusion process are described, and the requirements for this process are related to the potential lithium demand. An energy-supply scenario is developed which includes fusion as part of the mix. The lithium requirement for a developing fusion reactor economy is presented. (MOW)

7783 **Surface effects in controlled fusion devices.** Bauer, W.; Finfgeld, C.R.; Kaminsky, M. (eds.). New York; North-Holland Publishing Company (1976). 546p. (CONF-760209—). .

From 2. international conference on surface effects in controlled fusion devices; San Francisco, California, United States of America (USA) (16 Feb 1976).

Separate abstracts for individual papers have been included in the data base. (MOW)

GENERAL AND MISCELLANEOUS

MANAGEMENT

7784 (ERDA—77-41/9) **ERDA headquarters reports: January 1975—September 1977.** (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Administrative Services). 1977. 45p. Dep. NTIS, PC A05/MF A01.

This is the final cumulative record of reports and other publications issued from ERDA Headquarters. The four sections included are: a list of Headquarters-originated ERDA 77 and ERHQ reports received in the ERDA Library during the past month; all ERDA Headquarters reports already issued or scheduled to be issued, beginning with ERDA-1 of January 1975 and followed by the 1976 and 1977 reports; the ERDA Environmental Impact Statements and Assessments; the ERDA Environmental Development Plans; and ERHQ reports issued since January 1977. Reports which were in preparation at the time this issue was published are indicated by "(In preparation)" following the title; lists of ERDA and ERHQ reports arranged by the division or office at ERDA Headquarters responsible for their preparation and/or issuance; an index to keywords in the report titles.

7785 (TID—4045-S1) **Index to conference titles; selected conferences cited in the ERDA data base 1972—1977.** Hardin, N.E.; McGinnis, D.H. (eds.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Aug 1977. 473p. Dep. NTIS, PC A20/MF A01.

This publication cites energy-related conferences, meetings, symposia, and congresses within the programmatic interests of the Energy Research and Development Administration. It supplements and overlaps Index to Conferences Assigned CONF-Numbers by the Technical Information Center, U.S. Atomic Energy Commission (TID-4045), citing conferences held since January 1, 1972, and assigned a number in the CONF report number series. The Index contains two computer-produced listings, a KWIC (Key-Word-In-Context) index of the conference location and title and a listing numerically arranged by CONF number and providing location, date, and title information for each conference. (RWR)

7786 (UCRL—79595) **Algorithmic-interactive approach for scheduling and resource smoothing.** Lim, J.J.; Wells, J.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Aug 1977. Contract W-7405-ENG-48. 14p. (CONF-770932—1). Dep. NTIS, PC A02/MF A01.

From ORSA symposium; San Diego, California, USA (23 Sep 1977).

Conflicts often arise in allocating the resources in a multiproject, multiresource system. Consequently, deciding which projects to delay or schedule becomes a problem. Furthermore, it is often desirable to keep the usage of the resources as smooth as possible. A mathematical model of the resource-allocation problem is presented here. An algorithmic-interactive procedure for solving the problem is developed because the combinatorics of the mathematical model prevent an analytical solution. The procedure is shown to be a viable solution technique when solution results are compared with actual results after the procedure is applied to a scheduling and resource-allocation problem at Lawrence Livermore Laboratory. In this case, the procedure could have anticipated and alleviated many actual problem areas. 3 figures, 2 tables.

MATHEMATICS AND COMPUTERS

REFER ALSO TO CITATION(S) 6678, 7123, 7319, 7709

7787 (COO—2280-29) **TWO-STEP, user's guide. Solution of a linear system of equations using the exact two-step method.** Kobbe, R.; Bareiss, E.H.; Antolak, A. (Northwestern Univ., Evanston, Ill. (USA)). Feb 1977. Contract EY-76-S-02-2280. 34p. Dep. NTIS, PC A03/MF A01.

The use of the CDC-6400 Computer Program TWO-STEP for the exact solution of linear matrix equations over the integral domain is discussed. The rational result is given as output and also converted into decimal form to twenty decimal places.

7788 (LA-UR—77-893) **Effects of resource request patterns in queueing network models.** Keller, T.W. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 23p. (CONF-771107—1). Dep. NTIS, PC A02/MF A01.

From 6. annual symposium on operating systems principles; West Lafayette, Indiana, USA (16 Nov 1977).

Queueing network models of computing systems are becoming increasingly popular because of their robustness and ease of solution. The impact of resource request patterning upon these models is presently not well understood. This paper proves the counter-intuitive fact that the effect of both holding time and routing patterning upon the performance measures for the important class of local balance models is nil. A study of a larger class of models, over a parameter space typical of models of computing systems, reveals that the impact of patterning of resource requests upon performance measures is negligible. This conclusion has important consequences for understanding the robustness of queueing network models of computing systems and for the level of detail necessary for accurate workload characterization. The practical consequences of this result to performance analysis of computing systems are considered. 4 figures, 5 tables.

7789 (LA-UR—77-1877) **Some techniques for digital processing, display and interpretation of ratio images in multispectral remote sensing.** Wecksung, G.W.; Breedlove, J.R. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 9p. (CONF-770844—1). Dep. NTIS, PC A02/MF A01.

From International optical computing conference; San Diego, California, USA (25 Aug 1977).

A simple mathematical interpretation of the properties of ratio images derived from LANDSAT and other sources of multispectral imagery is presented. A spectral signature is defined which is well represented by ratios of pairs of spectral bands and can be related to the problem of clustering and unsupervised learning. Some practical problems arising in the generation of LANDSAT ratio images are considered, and an effective, simple method for reduction of the dynamic range of such images is presented along with digital image processing examples.

7790 (ORNL/CSD/TM—20) **User's manual for the hierarchial cluster analysis code DENDRO.** Larson, N.M.; Begovich, C.L.; Nall, V.C. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 86p. Dep. NTIS, PC A05/MF A01.

The computer code DENDRO is a multipurpose hierarchical cluster analysis program containing five data-normalization choices, seven metric options, and eight clustering criteria. This report is intended to be a user's manual for DENDRO, including equations describing each normalization, metric, and clustering option, results of application of DENDRO to various types of data sets, operating instructions, and sample input—output. 7 figures, 5 tables.

7791 (SAND—77-0871) **Linear algebraic equation polyalgorithm for the CDC 6600 and 7600. A user's guide for LEQSOL().** Hanson, R.J.; Wisniewski, J.A. (Sandia Labs., Albuquerque, N.Mex. (USA)). Aug 1977. Contract EY-76-C-04-0789. 48p. Dep. NTIS, PC A03/MF A01.

A guide for persons who must compute numerical solutions of linear algebraic systems of equations is presented. Subprogram usage instructions are presented. Five often-occurring FORTRAN program examples arising from linear algebraic equations are listed. These are the following: solving $Ax = b$, computing matrix products $A^{-1}D$ or EA^{-1}, iterative refinement, and determinant evaluation. A final example illustrates an analysis of a poorly conditioned problem. Some discussion of how to deal with constraint requirements on the solution should this occur is also presented. The subprogram for solving the systems is LEQSOL( ). The code has additional features beyond those of its Sandia Math Library counter-

part SAXB( ). One feature is to provide an estimate of the accuracy of the computed solution. The subprogram LEQSOL( ) is considerably more efficient than SAXB( ) for large values of N. 3 figures, 1 table.

7792 (SAND—77-1129) **Solving ordinary differential equations in SPEAKEASY.** Shampine, L.F. (Sandia Labs., Albuquerque, N.Mex. (USA)). Aug 1977. Contract EY-76-C-04-0789. 30p. Dep. NTIS, PC A03/MF A01.

SPEAKEASY does not have within it FORTRAN-type functions. A function like sin(x) is defined as a table of values at specified points and is held in the computer as an array. Because of this, the differential equation to be solved is defined only at certain points. This problem must be confronted; the algorithms and the code employing them do quite well at meeting the requirements for acceptable solution. The algorithms used are described, and step size, order, and errors are discussed. Several examples are given, along with a listing of subroutine SPKODE. (RWR)

7793 (UCID—30040(Ed.9)) **TRIX AC: a set of general-purpose text editing commands.** Cecil, A.; Moll, H.; Rinde, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Jul 1977. Contract W-7405-ENG-48. 64p. Dep. NTIS, PC A04/MF A01.

The AC dialect of the TRIX language is used at LLL to create and edit text files. This report describes the commands of the AC dialect. On the CDC 7600 computers at LLL, the AC dialect is invoked by the execute line TRIX AC, which calls up the TRIX interpreter and invokes the AC command set.

7794 (UCRL—80025) **Finite difference programs and array processors.** Rudy, T.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1977. Contract W-7405-ENG-48. 11p. (CONF-771032—1). Dep. NTIS, PC A02/MF A01.

From EPRI seminar) exploring applications of digital parallel processing to power systems analysis problems; Palo Alto, California, USA (4 Oct 1977).

An alternative to maxi computers for high-speed floating-point processing capabilities is the coupling of a host computer to a programable array processor. This paper compares the performance of two finite difference programs on various computers and their expected performance on commercially available array processors. The significance of balancing array processor computation, host-array processor control traffic, and data transfer operations is emphasized. 3 figures, 1 table.

7795 (UCRL—80053) **Multi-access storage subnetwork.** Wentz, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Sep 1977. Contract W-7405-ENG-48. 20p. (CONF-770937—1). Dep. NTIS, PC A02/MF A01.

From ERDA/AESOP 17; Boston, Massachusetts, USA (13 Sep 1977).

The Multi-Access Storage Subnetwork is the latest addition to the Octopus Computer Network at Lawrence Livermore Laboratory. When in production in early 1978, the Subnetwork will interface a Control Data Corporation 38500 Mass Storage Facility System to the host worker computers. This will provide an on-line capacity of 1×10^{12} bits of user storage. The MASS architecture provides a very high performance approach to the management of MASS Storage, as well as a high degree of reliability needed for operation in the Laboratory's time-sharing environment. The LLL-designe subsystem combines state-of-the-art digital hardware with an innovative system philosophy. The key design features of the subnetwork which contribute to high performance include a data transmission scheme which provides a 40-megabit-per-second channel over distances of up to 1,000 feet to link MASS with the worker computer disk systems; a 280-megabit-per-second, 24-port memory multiplexor controlling a large MOS memory used for intermediate buffer between the computers and the Mass Storage; and a set of high-speed microprocessor-based controllers driving the commercial Mass Storage units. Reliability of the system is provided by a completely redundant network including two control minicomputer systems. Also enhancing reliability is error detection and correction in the MOS buffer. A 64-bit hardware-generated checksum is carried with each file throughout the entire network, insuring integrity of user files being transferred via MASS. 10 figures.

INFORMATION HANDLING

7796 (ANL/ENG—77-01) **Argonne Braille Project.** Grunwald, A. (Argonne National Lab., Ill. (USA)). Jul 1977. Contract W-31-109-ENG-38. 360p. Dep. NTIS, PC A16/MF A01.

Development of a braille machine is summarized. It is noted that the machine has reached the stage where development of the system appears both possible and desirable. Sections are included containing papers on computer translation and auxiliary equipment, and on letters and awards in recognition of the braille machine development. (JRD)

7797 (LBL—6439) **LBL Socio-Economic-Environmental-Demographic Information System (SEEDIS) computer mapping systems workbook III. Programs DOBEDO—MAPEDIT—CARTE.** Burkhart, B.R.; Wood, P.M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1977. Contract W-7405-ENG-48. 237p. Dep. NTIS, PC A07/MF A01.

The aim of this writeup is to provide an analyst with sufficient information to make computer maps of socio-economic or environmental data. The writeup is concerned primarily with the execution of programs rather than a comprehensive and exhaustive treatment of theoretical details. Illustrative examples are included for the major programs, including a visual, step-by-step map design workbook for the CARTE program. The writeup is divided into three parts. Part A describes the LBL Socio-Economic-Environmental-Demographic Information System, of which the computer mapping system is a part. Part B, a tutorial, covers the polygon-based mapping system and its component programs. Part C gives an illustrated introduction to the grid-based mapping system at LBL. The Appendices include a User Manual for the batch mode versions of the programs MAPEDIT, ZING, and CARTE. Appendix D includes a variety of color maps produced from various projects using the SEEDIS data base. (RWR)

7798 (ORNL/CSD/TM—31) **Description and price for the ERDA Energy Information Data Base on computer tape.** Price, C.E. (Oak Ridge National Lab., Tenn. (USA)). Sep 1977. Contract W-7405-ENG-26. 12p. Dep. NTIS, PC A02/MF A01.

The ERDA Energy Information Data Base (EEDB) is a bibliographic data base containing descriptions of scientific and technical documents on all areas of energy. EEDB is prepared by the ERDA Technical Information Center (TIC). Presently, about 150,000 new references are being added each year. Computer readable magnetic tapes containing a digital representation of the EEDB are available for purchase and can be provided either on a subscription basis with 24 issues per year or in various cumulations as outlined herein. This document contains a brief description of the EEDB tapes and a price schedule.

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In the corporate index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

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DOE Energy Information Data Base: Corporate Author Entries (TID-4585) is used in the standardization of corporate entries. TID-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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Abt Associates, Inc., Cambridge, Mass. (USA)
In the bank...or up the chimney. A dollars and cents guide to energy-saving home improvements, 3:6907 (HUD-PDR—89(3))
Advanced Energy and Technology Associates, Dover, N.H. (USA)
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Air Pollution Systems, Inc., Seattle, Wash. (USA)
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report, 3:6559 (EPRI-FP—291(Vol.2))
Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office
Evaluation of methods for immobilizing solids loaded with krypton-85, 3:6056 (ICP—1130)
American Association of Small Research Companies, Washington, D.C.
Opportunities at ERDA for small R and D companies. Small business proceedings, 3:6888 (CONF-760360—)
American Nuclear Society, Chicago, Ill.
Fast reactor safety and related physics. Volume II. Licensing; safety-related design, 3:6721 (CONF-761001—P2)
Fast reactor safety and related physics. Volume III. Accident analysis; structural dynamics, 3:6732 (CONF-761001—P3)
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Atomics International Div., Canoga Park, Calif. (USA)
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Commercial applications of solar total energy systems. Second quarterly progress report, August 1, 1976—October 31, 1976, 3:6242 (AI-ERDA—13200)
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High-temperature piping design technology. Quarterly technical progress report, April—June 1977, 3:6621 (AI-ERDA—13206)
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Atomics International Div., Golden, Colo. (USA)
Waste management analysis for the nuclear fuel cycle: parts I and II. Progress report for period ending March 31, 1977, 3:6059 (RFP—2667)

Atomics International Div., Golden, Colo. (USA). Rocky Flats Plant
Alternate fuel cycle technologies, nitrate-to-oxide conversion project. Progress report, January—June 1977, 3:6049 (RFP—2591)

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Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.
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400-MWe consolidated nuclear steam system (CNSS): 1200-MWt/ conceptual design, 3:6591 (ORNL/Sub—4390/4)

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Battelle Columbus Labs., Ohio (USA)
Study of heat transfer through refractory lined gasifier vessel walls. Quarterly progress report, March—May 1977, 3:5787 (FE—2210-16)
Study of heat transfer through refractory lined gasifier vessel walls. Monthly technical progress report, August 1977, 3:5788 (FE—2210-19)
Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn. Volume IV. Corn agriculture. Task 77, final report, 3:6205 (BMI—1957A(Vol.4))
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Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)
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California Univ., Berkeley (USA)
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California Univ., Berkeley (USA). Lawrence Berkeley Lab.
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California Univ., Berkeley (USA). Operations Research Center
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California Univ., Los Angeles (USA). School of Engineering and Applied Science
Natural convection in horizontal fluid layers, 3:7631 (NUREG—0261)
California Univ., Santa Barbara (USA)
Damage correlation in theory and practice, 3:6685 (HEDL-SA—1144-A)
High energy user group at Santa Barbara. Progress report, May 1976—March 1977, 3:7635 (UCSB-GEN-10-PA23—31)
Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)
System analysis and engineering studies for ocean thermal energy conversion. Final report, January 1, 1976—September 30, 1976, 3:6263 (COO/2895—7)
Case Western Reserve Univ., Cleveland, Ohio (USA)
Coupled diffusion phenomena in multicomponent glasses and glass forming liquids. Progress report, September 1, 1976—June 1, 1977, 3:7104 (COO—4075-1)
Improved cathodes for phosphoric acid fuel cells. Final report, 3:6994 (EPRI-EM—505)
Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Physics
Program in medium energy nuclear physics research. Technical progress report, 1 September 1976—30 November 1977, 3:7685 (COO—2146-11)
CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)
Experience acquired in regard to evaporating liquid radioactive waste and solidifying evaporation sludge at the Centres D'Etudes Nuclearies de Fontenay-aux-Roses and de Grenoble, 3:6063 (ORNL-tr—4419)
CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)
Corrosion by uranium hexafluoride. Part 2, 3:7185 (GAT-Z—5049)
Operating manual for the Hera magnet, Sections 1—3, 3:7281 (LA-tr—77-55)
CEA, 75 - Paris (France)
Utilization of waste heat from nuclear power plants, 3:7053 (ORNL-tr—4385)
Chicago Univ., Ill. (USA)
Study of vibrational and electronic excitations in ordered and disordered solids. Progress report, September 1, 1976—August 31, 1977, 3:7113 (COO—2126-37)
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Mariner 9 power subsystem design and flight performance, 3:6833 (N—73-25096)
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Clark Univ., Worcester, Mass. (USA)
Preliminary feasibility study of a grid-connected integrated community energy system at Clark University. Volume I. Executive summary, 3:6901 (COO—4211-1/1)
Clinch River Breeder Reactor Plant Project Office, Oak Ridge, Tenn. (USA)
Clinch River Breeder Reactor Plant. Technical review, Fall 1977, 3:6638 (CRBRP-PMC—77-04)
College of William and Mary, Williamsburg, Va. (USA)
Effects of pressure anisotropy on the stability of the guiding center plasma. Progress report, September 15, 1976—December 14, 1977, 3:7741 (ORO—5260-1)
Colorado Energy Research Inst., Golden (USA)
Energy conservation in Colorado, 3:6903 (CONF-7509194—)
Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.
Evaluation of a residential solar air heating system. Interim progress report, August 1976—May 1977, 3:6276 (COO/2868—2)
Columbia Gas Transmission Corp., Charleston, W.Va. (USA)
Tertiary oil recovery by CO_2 injection. Monthly report, March 1977, 3:5925 (ORO/5302—8)
Columbia Univ., New York (USA). Dept. of Physics
Theoretical high energy physics. Progress report, May 1, 1976—April 30, 1977, 3:7653 (COO—2271-100)
Columbia Univ., New York (USA). Plasma Physics Lab.
Shock-tube study of fusion plasma-wall interactions, 3:7778 (COO—2456-47)
Combustion Engineering, Inc., Windsor, Conn. (USA)
System design of carbide fuel. Quarterly progress report, April—June 1977, 3:6634 (COO—2426-101)
Combustion Power Co., Inc., Menlo Park, Calif. (USA)
Energy conversion from coal utilizing CPU-400 technology. Final report. Volume I, 3:5878 (FE—1536-30(Vol.1))
Energy conversion from coal utilizing CPU-400 technology. Final report, Volume II, 3:5879 (FE—1536-30(Vol.2))
Energy conversion from coal utilizing CPU-400 technology. Volume I. Final report, 3:5881 (FE/1536—1)
Granular bed filter development program monthly report for July 1977, 3:6560 (FE—2579-8)
Commission of the European Communities, Brussels (Belgium)
Solar energy research in European Communities, 3:6118 (AED-Conf—77-027-005)
Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center
Proceedings of the first ASTM-EURATOM symposium on reactor dosimetry. Part I, 3:6683 (EUR—5667-e/f(Pt.1))
Proceedings of the first ASTM-EURATOM symposium on reactor dosimetry. Part II, 3:6684 (EUR—5667-e/f(Pt.2))
Cornell Univ., Ithaca, N.Y. (USA)
Direct observation of grain boundary diffusion by scanning Auger microscopy, 3:7092 (COO—2679-14)
Cornell Univ., Ithaca, N.Y. (USA). Lab. of Plasma Studies
Stability of high energy focused ion beams for pellet fusion in target chamber, 3:7772 (ORO—5000-4)
Creare, Inc., Hanover, N.H. (USA)
Preliminary ramped transient analysis with superheated walls. Quarterly progress report, April 1, 1977—June 30, 1977, 3:6787 (CREARE-TN—261)
Crystal Systems, Inc., Salem, Mass. (USA)
Heat exchanger-ingot casting/slicing process. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Seventh quarterly progress report, March 22, 1977—June 30, 1977, 3:6186 (ERDA/JPL/954373—77/2)

D

Defense Documentation Center, Alexandria, Va. (USA)
Batteries, 3:6822 (AD—768500/1)
Department of Commerce, Washington, D.C. (USA)
International decade of ocean exploration. Progress report, Volume 6, April 1976—April 1977, 3:7617 (NP—22650)
Department of Energy, Pittsburgh, Pa. (USA). Pittsburgh Energy Research Center
Automatic recording plastometer for plastic properties of coal, 3:5813 (PERC/RI—77/11)
Deutscher Verband fuer Wasserwirtschaft e.V., Essen (Germany, F.R.)
Proceedings of the international symposium on fossil fuel production and water resources, 3:5830 (CONF-7609125—)
Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)
Battery system within the energy supply for Aeros battery system, 3:6826 (N—74-26516/6)
Dow Chemical Co., Midland, Mich. (USA)
Solar energy subsystems employing isothermal heat sink materials. Final project report, September 18, 1974—March 18, 1976, 3:6354 (PB—258738)
Dow Chemical Co., Midland, Mich. (USA). Hydrocarbons and Energy Research Dept.
Energy from in situ processing of Antrim shale. Monthly technical progress report for August 1977, 3:5993 (FE—2346-14)
Drexel Univ., Philadelphia, Pa. (USA)
Industrial applications study. Volume I. Executive summary: industrial waste energy data base technology evaluation. Final report, 3:6905 (COO/2862—1)
Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.
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Dynatech R;D Co., Cambridge, Mass. (USA)
Investigation of converting the products of coal gasification to methane by the action of microorganisms: Phase I. Final report, November 1, 1975—December 1, 1976, 3:6112 (FE—2203-17)

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EG and G Idaho, Inc., Idaho Falls (USA)
Axial gas flow in irradiated PWR fuel rods, 3:6593 (TREE-NUREG—1158)
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LOFT integral test system final safety analysis report. Revision I, 3:6806 (TID—22797)
LOFT integral test system final safety analysis report. Revision I, 3:6672 (TID—22796)
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THERRP: a thermodynamic properties program, 3:6458 (TREE—1081)

Electric Power Research Inst., Palo Alto, Calif. (USA)
EPRI polymer concrete workshop, Palo Alto, California, March 14—15, 1977. Special report, 3:7110 (EPRI-EL—492-SR)
Overview of stoppering of open magnetic containment systems for controlled fusion, 3:7718 (EPRI-ER—394-SR)

Eltra Corp., Plymouth Meeting, Pa. (USA). C and D Batteries Div.
Development of a lead acid battery suitable for electric vehicle propulsion. Final report, 3:6823 (ANL-K—77-3628-1)

Eltra Corp., Plymouth Meeting, Pa. (USA). Electric Vehicle Group
Development of a lead acid battery suitable for electric vehicle propulsion. Final report, 3:6823 (ANL-K—77-3628-1)

Eltra Corp., Plymouth Meeting, Pa. (USA). Prestolite Battery Div.
Development of a lead acid battery suitable for electric vehicle propulsion. Final report, 3:6823 (ANL-K—77-3628-1)

Energy, Inc., Idaho Falls, Idaho (USA)
RETRAN: a program for one-dimensional transient thermal—hydraulic analysis of complex fluid flow systems. Volume I. Equations and numerics. Final report, 3:6788 (EPRI-NP—408)
RETRAN sensitivity studies of light water reactor transients. Final report, 3:6789 (EPRI-NP—454)

Energy Research and Development Administration, Bartlesville, Okla. (USA). Bartlesville Energy Research Center
New Look at odorization levels for propane gas, 3:5983 (BERC/RI—77/1)
Valve timing: its effect on emissions and fuel economy, 3:7072 (BERC/RI—77/9)

Energy Research and Development Administration, Grand Junction, Colo. (USA). Grand Junction Office
Drilling in the Monument Valley Area of Arizona and Utah, 3:6017 (RMO—830(Rev.))

Energy Research and Development Administration, Laramie, Wyo. (USA). Laramie Energy Research Center
Thermal analysis on oil shale: determination of potential oil yields and dawsonite, nahcolite, and nordstrandite content, 3:6007 (LERC/RI—77/6)

Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center
Controlled fusion and plasma research: a literature search, 3:7714 (TID—3557-S12)
Index to conference titles; selected conferences cited in the ERDA data base 1972—1977, 3:7785 (TID—4045-S1)

Energy Research and Development Administration, Pittsburgh, Pa. (USA). Pittsburgh Energy Research Center
Screening for hazardous elements and compounds in process streams of the 1/2 ton per day SYNTHOIL process development unit, 3:5807 (PERC/RI—77/12)

Energy Research and Development Administration, Washington, D.C. (USA)
Consumer Products and Technology Branch program plan, 3:6906 (ERDA—77-81)
High Flux Neutron Source Facility, Hanford Reservation, Richland, Washington. Draft environmental impact statement, 3:7438 (ERDA—1556-D)
High Performance Fuel Laboratory, Hanford Reservation, Richland, Washington. Final environmental impact statement, 3:6024 (ERDA—1550)
Inexhaustible energy resources study, 3:6979 (CONF-770715—)
Report of the 1977 Subpanel on New Facilities of the High Energy Physics Advisory Panel to the Energy Research and Development Administration, 3:7288 (ERDA—77-71)
Report on strategic special nuclear material inventory differences, 3:6081 (ERDA—77-68)
Safety research experiment facilities, Idaho National Engineering Laboratory, Idaho. Final environmental impact statement, 3:6702 (ERDA—1552)
Source Evaluation Board handbook. Procurement regulations handbook No. 1, 3:6844 (ERHQ—0013)

Energy Research and Development Administration, Washington, D.C. (USA). Div. of Administrative Services
ERDA headquarters reports: January 1975—September 1977, 3:7784 (ERDA—77-41/9)

Energy Research and Development Administration, Washington, D.C. (USA). Div. of Basic Energy Sciences
Materials Sciences Programs, 3:7077 (ERDA—77-123)

Energy Research and Development Administration, Washington, D.C. (USA). Div. of Biomedical and Environmental Research
Effects of trace contaminants from coal combustion. Proceedings of a workshop, Knoxville, Tennessee, August 2—6, 1976, 3:5877 (ERDA—77-64)

Energy Research and Development Administration, Washington, D.C. (USA). Div. of Geothermal Energy
Hot dry rock geothermal energy: status of exploration and assessment. Report No. 1 of the hot dry rock assessment panel, 3:6365 (ERDA—77-74)

Energy Research and Development Administration, Washington, D.C. (USA). Div. of Magnetic Fusion Energy
Atomic data needs for magnetic fusion energy. Report of an Ad Hoc Panel meeting, Knoxville, Tennessee, February 15, 1977, 3:7730 (ERDA—77-73)

Energy Research and Development Administration, Washington, D.C. (USA). Div. of Solar Energy
Proceedings of the ERDA semiannual photovoltaic advanced materials program review meeting, 3:6146 (CONF-770318—)
Solar energy for agriculture and industrial process heat, 3:6298 (ERDA—77-72)

Environmental Law Inst., Washington, D.C. (USA)
Legal barriers to solar heating and cooling of buildings, 3:6141 (DSE/2528—1)

Escher Technology Associates, St. Johns, Mich. (USA)
Hydrogen-fueled railroad motive power systems: a feasibility study, 3:7076 (CONS/4707—1)

European Nuclear Society, Petit-Lancy (Switzerland)
Fast reactor safety and related physics. Volume II. Licensing; safety-related design, 3:6721 (CONF-761001—P2)
Fast reactor safety and related physics. Volume III. Accident analysis; structural dynamics, 3:6732 (CONF-761001—P3)
Fast reactor safety and reiated physics. Volume IV. Phenomenology, 3:6772 (CONF-761001—P4)

European Organization for Nuclear Research, Geneva (Switzerland)
Beam size blow-up and current loss in the Fermilab main ring during storage, 3:7271 (BNL—23044)
Bunch lengthening in the Fermilab main ring during storage, 3:7272 (BNL—23045)

Exxon Nuclear Co., Richland, Wash. (USA)
Exxon Nuclear Company ECCS evaluation of a 2-loop Westinghouse PWR with dry containment using the ENC WREM-II ECCS model. Large break example problem, 3:6809 (XN-NF—77-25)

F

Faucett (Jack) Associates, Inc., Chevy Chase, Md. (USA)
Sampling plans for lightning surges test program. Final report, May 1976—January 1977, 3:6570 (CONS/2107—1)

Federal Power Commission, Washington, D.C. (USA). Bureau of Natural Gas
Maintenance and adjustment manual for natural gas and No. 2 fuel oil burners, 3:7050 (TID—27600)
Federal Trade Commission, Washington, D.C. (USA). Bureau of Economics
Effects of Federal price and allocation regulations on the petroleum industry. Staff report to the Federal Trade Commission, 3:5976 (NP—22430)
Fermi National Accelerator Lab., Batavia, Ill. (USA)
Computer simulation of bunch lengthening and widening in proton storage rings, 3:7274 (CONF-770709—10)
Effects limiting accelerated beam intensity in the largest proton synchrotron, 3:7275 (CONF-770709—12)
Energy Doubler/Saver at Fermilab: a status report, 3:7265 (CONF-770709—1)
Fermi National Accelerator Laboratory monthly report, June 1977, 3:7268 (FERMILAB—77/6)
Fermilab accelerator: status and development plans, 3:7267 (CONF-770709—9)
Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)
Analysis of the application of energy demand in the West German chemical industry, 3:6974 (AED-Conf—77-072-002)
Florida Univ., Gainesville (USA). Engineering and Industrial Experiment Station
Deformation processes in refractory metals, 3:7085 (ORO—3262-54)
Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)
Determination of a radioactive waste classification system. Final report, 3:6067 (UCRL—13770)
Generic environmental assessment for implementing a radioactive waste classification system, 3:6078 (UCRL—13771)
Ford Motor Co., Dearborn, Mich. (USA)
80- to 100-hp Stirling engine feasibility study. Progress report No. 21, January—March 1977, 3:7062 (COO—2631-21)
Automotive gas turbine ceramic regenerator design and reliability program. Final annual report, July 1, 1975—September 30, 1976, 3:7073 (COO—2630-18)
Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)
Positron emission computed tomography using large area detectors, 3:7290 (CONF-770685—2)
Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung
Building regulations; planning of building constructions and housing development areas taking into account the utilization of solar energy, 3:6274 (AED-Conf—77-027-003)

G

Gary Operating Co., Englewood, Colo. (USA)
Pilot demonstration-enhanced oil recovery by micellar-polymer waterflooding Bell Creek Field. Monthly technical progress report, June 1977, 3:5924 (COO—4207-12)
General Atomic Co., San Diego, Calif. (USA)
Alloy 800 for nuclear reactor applications, 3:7080 (GA-A—14111)
Design evaluation of the 20-cm (8-inch) secondary burner system, 3:6029 (GA-A—14510)
Evaluation of carbon deposition and possible consequences in the HTGR: a review, 3:6601 (GA-A—13982)
Gas turbine and advanced HTGR materials screening test program: 10,000-hour results and semiannual progress report for the period ending March 31, 1977, 3:6604 (GA-A—14407)
HTGR containment design options: an application of probabilistic risk assessment, 3:6602 (GA-A—14147)
HTGR fuels and core development program. Quarterly progress report for the period ending May 31, 1977, 3:6605 (GA-A—14418)
Low-enrichment and denatured (thorium) fuels for the HTGR: a status report, 3:6606 (GA-A—14606)
Postirradiation examination of Peach Bottom fuel test element FTE-4, 3:6600 (GA-A—13452)
STAT, GAPS, STRAIN, DRWDIM: a system of computer codes for analyzing HTGR fuel test element metrology data. User's manual, 3:6603 (GA-A—14274)
Thorium utilization program. Quarterly progress report for the period ending May 31, 1977, 3:6028 (GA-A—14441)
General Electric Co., Philadelphia, Pa. (USA). Space Div.
Two component thermal storage material study, Phase 2. Interim progress report, June 1976—December 1976, 3:6353 (COO/2845—77/1)
General Electric Co., Pleasanton, Calif. (USA). Vallecitos Nuclear Center
GETR multi-channel core model for simulating internal natural circulation, 3:6797 (NEDO—12663)
GETR technical specifications, 3:6710 (NP—22477)
General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.
Contribution of fuel rod deposits to the buildup of radiation on out-of-core surfaces of the Nine Mile Point 1 BWR, 3:6577 (NEDC—13461)
Examination of the failed feedwater sparger from Humboldt Bay 3: 1976 outage, 3:6578 (NEDO—21488)
General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.
Mark I Containment Program: Program Action Plan. Revision 2, 3:6579 (NP—22399)
General Electric Co., Schenectady, N.Y. (USA)
Impact of solar energy on electric utility generation system reliability and operations, 3:6219 (CONF-770403—3)
Large area silicon sheet task low-cost silicon solar array project. Sixth quarterly progress report, 4 April 1977—1 July 1977, 3:6183 (ERDA/JPL/954350—77/2)
Near-term electric vehicle program: Phase I, final report, 3:7065 (SAN/1294—1)
General Electric Co., Schenectady, N.Y. (USA). Energy Systems Programs Dept.
CFCC development program monthly report for April 1977, 3:6524 (FE—2357-14)
CFCC development program monthly report for July 1977, 3:6525 (FE—2357-15)
General Electric Co., Schenectady, N.Y. (USA). Power Systems Lab.
Conceptual design for a pilot/demonstration compressed air storage facility employing a solution-mined salt cavern, 3:6815 (EPRI-EM—391)
General Electric Co., Sunnyvale, Calif. (USA). Energy Systems and Technology Div.
CRBRP flow induced vibration program, 3:6632 (CONF-770933—1)
General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.
Core engineering sixty-second quarterly report, February—April 1977, 3:6640 (GEFR—10028-62)
General Research Corp., Santa Barbara, Calif. (USA)
Cost analysis of lasers for a laser isotope separation system. Final report, 3:6022 (UCRL—13744-2)
Geological Survey, Denver, Colo. (USA)
Lithium resources and requirements by the year 2000, 3:6879 (USGS—1005)
Geological Survey, Las Vegas, Nev. (USA)
Catalog of seismic records obtained in support of the ERDA/Nevada Operations Office, October 1963—June 1976, 3:7333 (USGS—474-183)
Geological Survey, Reston, Va. (USA)
Fluid flow and ionic diffusion and their roles in the genesis of sandstone-type uranium ore bodies, 3:6008 (USGS-OFR—76-454)
Uranium and thorium resource assessment and exploration research program, fiscal year 1977, 3:6009 (USGS-OFR—77-218)
Georgia Inst. of Tech., Atlanta (USA). School of Electrical Engineering
Computer program for determination of earth potentials due to faults or loss of concentric neutral on URD cable, 3:6572 (EPRI-EL—545)
Georgia Univ., Athens (USA)
RNA metabolism in the regulation of protein synthesis in plants. Progress report summary, July 1976—August 1977, 3:7488 (SRO—643-14)
Georgia Univ., Athens (USA). Dept. of Chemistry
Effects on gas chromatographic peaks of electric fields applied across cholesteric liquid crystal stationary phases, 3:7167 (SRO—854-16)
Positive pressure columns used for solvent cleanup or chromatography, 3:7141 (SRO—854-17)
Georgia Univ., Athens (USA). Southeastern Cooperative Wildlife Disease Study
Diseases of white-tailed deer. Chapter 5. Neoplasia, 3:7494 (CONF-770832—1)

Giner, Inc., Waltham, Mass. (USA)
Study of corrosion and its control in aluminum solar collectors. Progress report, December 1, 1976—February 28, 1977, 3:6325 (COO/2934—3)
Study of corrosion and its control in aluminum solar collectors. Annual progress report, June 1, 1976—May 31, 1977, 3:6326 (COO/2934—4)
Gordian Associates, Inc., New York (USA)
Industrial international data base: the steel industry, pilot study. Final report, 3:6976 (NATO/CCMS—47)
International technology transfer: a discussion of opportunities, incentives, and barriers to international technology transfer and the role of the Federal Government in its promotion, 3:6912 (TID—27650)
Gould, Inc., Colmar, Pa. (USA). Research and Development Div.
SF_6 foamed insulation. Final report, 3:6571 (EPRI-EL—520)
Gould, Inc., Mendota Heights, Minn. (USA)
Non-gassing nickel—cadmium battery electrodes and cells. Testing of 25-Ah cells. Supplementary report, 25 August 1972—25 November 1972, 3:6831 (N—73-19060)
Grumman Aerospace Corp., Bethpage, N.Y. (USA)
OAO battery data analysis. Final report, 3:6832 (N—73-20045)
Grumman Aerospace Corp., Bethpage, N.Y. (USA). Research Dept.
Development and application of the PLANS computer program for analysis of nuclear reactor structural components, 3:6657 (ORNL/Sub—4485/1)
Gulf General Atomic Co., San Diego, Calif. (USA)
Structural analysis of the gas-cooled fast breeder reactor core support, 3:6639 (GA-A—14098)
Gulf Research and Development Co., Pittsburgh, Pa. (USA)
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Monthly progress report, Aug 1977, 3:5790 (FE—2305-14)

H

Hanford Engineering Development Lab., Richland, Wash. (USA)
Computerized x-ray radiographic system for fuel pellet measurements, 3:6694 (HEDL-TME—76-92)
CRBRP flow induced vibration program, 3:6632 (CONF-770933—1)
Damage correlation in theory and practice, 3:6685 (HEDL-SA—1144-A)
Dimensional analysis of FFTF driver fuel assemblies, 3:6708 (HEDL-TME—77-77)
Division of Waste Management, Production, and Reprocessing programs progress report for January—December 1976, 3:6054 (HEDL-TME—77-40)
Division of Waste Management, Production, and Reprocessing programs progress report for January—June 1977, 3:6055 (HEDL-TME—77-74)
FSAR amendment 5, revisions to supplement 6, 3:6666 (HEDL-TI—75002-5)
Liquid velocity measurements in outlet plenum of FFTF hydraulic core mockup, 3:6705 (HEDL-TME—76-4)
LMFBR reference control materials. Semiannual report, July—December 1976, 3:6696 (HEDL-TME—77-33)
Method for measuring differential control rod worth at power, 3:6697 (HEDL-TME—77-75)
Removal of sodium from the IVHM orientation plug, 3:6707 (HEDL-TME—77-63)
Sodium engineering and technology technical progress report, October, November, December 1976, 3:6641 (HEDL-TME—76-28)
Temperature dependence of in-reactor creep of 20% cold worked 316 stainless steel, 3:7101 (HEDL-SA—1187)
Theoretical prediction of microstructural development during irradiation, 3:7100 (HEDL-SA—1157)
Thermal performance tests of the FFTF closed loop cold trap, 3:6706 (HEDL-TME—77-20)
Harvard Univ., Cambridge, Mass. (USA)
Technical-economic modeling in energy planning, 3:6846 (BNL—23087)
Hawaii Univ., Honolulu (USA). Hawaii Geothermal Project
Geothermal power economics: an annotated bibliography. Volume I, 3:6420 (NP—21253-P1)
Helsinki Univ. (Finland). Dept. of Radiochemistry
Plutonium and americium in the foodchain lichen-reindeer-man, 3:7434 (CONF-770409—11)
Historical Evaluation and Research Organization, Dunn Loring, Va. (USA)
Study of breakthrough operations. Final report, 3:7334 (SAND—77-8175)
Hittman Associates, Inc., Columbia, Md. (USA)
Barriers connected with certifying or listing of energy-conserving products used in buildings, 3:6904 (CONS/1211—1)
Honeywell, Inc., Minneapolis, Minn. (USA). Energy Resources Center
Hydraulic accumulators for hybrid automobiles and transport vehicles, 3:7070 (UCRL—13757)
Hydrocarbon Research, Inc., Trenton, N.J. (USA)
Development of a fast fluid bed gasifier. Phase 1, Task 1. Interim report, July—October 1976. Volume III. Appendix B: drawings, 3:5791 (FE—2361-4(Vol.3))

I

ICF, Inc., Washington, D.C. (USA)
Project Independence Evaluation System (PIES) documentation. Volume XI. Finance submodel for the FEA oil and gas supply model, 3:6957 (PB—269948)
Project Independence Evaluation System (PIES) documentation. Volume X. Automation of finding rate and discount rates in the FEA gas supply model, 3:6960 (PB—269947)
Idaho National Engineering Lab., Idaho Falls (USA)
Fast reactor fission yields for ^{239}Pu and ^{241}Pu, 3:6642 (ICP—1050-11)
Illinois Benedictine Coll., Lisle (USA). Physical Sciences Lab.
Special problems in nuclear instrumentation. Progress report, September 1, 1976—November 30, 1977, 3:7295 (COO—323-39)
Illinois State Water Survey, Urbana (USA)
1964 Project Springfield studies. Research Report 2, 3:7417 (COO—1199-7)
Illinois Univ., Urbana (USA)
Reversed field decay times, 3:7759 (COO—2218-80)
Illinois Univ., Urbana (USA). Center for Advanced Computation
Energy analysis: handbook for combining process and input—output analysis, 3:6847 (ERDA—77-61)
Illinois Univ., Urbana (USA). Dept. of Civil Engineering
Biological conversion of biomass to methane. Quarterly progress report, December 1, 1976—March 31, 1977, 3:6209 (COO/2917—4)
Illinois Univ., Urbana (USA). Gaseous Electronics Lab.
Potential well formation in electrostatic confinement devices. Technical progress report, 3:7717 (COO—2323-6)
Indiana Univ., Bloomington (USA). Dept. of Physics
Preliminary measurements of proton polarization in high energy inclusive processes, 3:7645 (COO—2009-129)
Preliminary polarization results at Fermilab energies, 3:7644 (COO—2009-128)
Theoretical particle physics. Progress report, December 1, 1976—November 30, 1977, 3:7651 (COO—2009-133)
Institute for Advanced Study, Princeton, N.J. (USA)
Quantum fluctuations of pseudoparticles in the nonlinear sigma-model, 3:7652 (COO—2220-108)
Institute for Energy Analysis, Oak Ridge, Tenn. (USA)
Energy cost of energy: guidelines for net energy analysis of energy supply systems, 3:6848 (ORAU/IEA(R)—77-14)
Institute of Gas Technology, Chicago, Ill. (USA)
Environmental assessment of the HYGAS Process. Monthly progress report, April 1—April 30, 1977, 3:5794 (FE—2433-13)
Melting behavior of coal ash materials from coal ash composition, 3:5821 (CONF-770583—1)
Outlook for new sources of gas supply, 3:6959 (CONF-761162—)
Intermagnetics General Corp., Guilderland, N.Y. (USA)
Production of multifilamentary Nb_3Sn composites incorporating a high tin bronze, 3:7761 (UCRL—13717)
International Atomic Energy Agency, Vienna (Austria)
Management of radioactive waste in Belgium, 3:6052 (BNWL-tr—264)
Medical radionuclide imaging. Proceedings series. Volume I, 3:7492 (STI/PUB—440(Vol.1))
Medical radionuclide imaging. Proceedings series. Volume II, 3:7493 (STI/PUB—440(Vol.2))

International Atomic Energy Agency, Vienna (Austria). International Working Group on Fast Reactors
International working group on fast reactors, 3:6643 (IWGFR—5)
International Inst. for Applied Systems Analysis, Laxenburg (Austria)
Solar energy task progress report for 1975/76: evaluation of solar energy options, 3:6144 (IIASA-RM—77-20)
Systems aspects of large-scale solar energy conversion, 3:6145 (IIASA-RM—77-23)

J

Jet Propulsion Lab., Pasadena, Calif. (USA)
Evaluation of new plastic compression (Ziegler) type of seals for long-life planetary batteries, 3:6835 (N—73-17040)
Experimental evaluation of a fixed collector employing vee-trough concentrator and vacuum tube receivers, 3:6324 (CONF-771120—9)
Project SAGE. Solar assisted gas energy. Interim report No. 1, 3:6984 (TID—27755)
Johns Hopkins Univ., Baltimore, Md. (USA)
Molecular basis for the mutagenic and lethal effects of ultraviolet irradiation. Progress report, 3:7501 (TID—27764)
Johns-Manville Sales Corp., Denver, Colo. (USA)
Filtration process and equipment studies for coal liquefaction processes. Monthly report, July 1977, 3:5800 (FE—2007-35)
Filtration process and equipment studies for coal liquefaction processes. Monthly report, August 1977, 3:5801 (FE—2007-36)

K

Kaman Sciences Corp., Colorado Springs, Colo. (USA)
Safety analysis of an HTGR plant including emergency shutdown. Volume 1. Final report, 3:6810 (K—76-124U(R)(Vol.1))
Kansas Univ., Lawrence (USA)
Radiochemistry of iodine, 3:7182 (NAS-NS—3062)
Kent State Univ., Ohio (USA)
Energetic-neutron spectrometry. Progress report, 1 June 1976—31 August 1977, 3:7299 (COO—2231-38)
Keplinger and Associates, Inc., Tulsa, Okla. (USA)
Natural gas acquisition, 3:5984 (CONF-770144—1)
Reserves: a better understanding, 3:5890 (NP—22424)
Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung
Uniaxial creep tests on tubular specimens of stainless steels X10NiCrMoTiB 1515 (1.4970) and X8CrNiMoVNb 1613 (1.4988), 3:7087 (EURFNR—1358)
Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik
KEDAK program compendium. Part V. KEDAK evaluation aids, 3:7699 (EURFNR—1450)

L

Lake County Air Pollution Control District, Lakeport, Calif. (USA)
Geothermal environmental seminar, 3:6423 (CONF-7511133—)
Lehigh Univ., Bethlehem, Pa. (USA)
Pressure sintering and creep deformation: a joint modeling approach. Progress report, January 1, 1977—December 31, 1977, 3:7102 (COO—2408-4)
Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif. (USA)
Ocean Thermal Energy Conversion (OTEC) test facilities study program. Final report. Volume II. Part C, 3:6265 (SAN/1156—77/1(Vol.2)(Pt.C))
Ocean Thermal Energy Conversion (OTEC) test facilities study program. Final report. Volume II. Part A, 3:6266 (SAN/1156—77/1(Vol.2)(Pt.A))
Ocean Thermal Energy Converstion (OTEC) test facilities study program. Final report. Volume II. Part B, 3:6264 (SAN—1156/77/1(Vol.2)(Pt.B))
Los Alamos Scientific Lab., N.Mex. (USA)
Accelerating and focusing structures for PIGMI, 3:7279 (LA-UR—77-1545)
Active and passive solar heating of buildings, 3:6279 (LA-UR—77-1555)
Alignment system for large high-power CO_2 laser fusion systems, 3:7769 (LA-UR—77-1923)
Altered growth and RNA metabolism in cultured Chinese hamster ovary cells exposed to low levels of cadmium. Progress report, July 1, 1976—June 30, 1977, 3:7557 (LA—6976-PR)
Carbonation of cerium oxychloride, 3:6101 (LA-UR—77-2030)
Comparisons of calculated and experimental delayed fission-product beta and gamma spectra from ^{235}U thermal fission, 3:7688 (LA-NUREG—6896-MS)
Computer system for radiation therapy with negative pions, 3:7504 (LA-UR—77-2053)
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Hybrid computers for simulation of gas diffusion in fractured shale, 3:5986 (LA-UR—77-2066)
Medium-energy physics program. Progress report, November 1, 1976—January 31, 1977, 3:7269 (LA—6819-PR)
nD scattering at 180° for neutron energies from 200 to 800 MeV, 3:7646 (LA-UR—77-1938)
Nondestructive assay instruments for the DYMAC program at the Los Alamos Scientific Laboratory, 3:6084 (LA-UR—2247)
Nuclear reactor safety. Quarterly progress report, April 1—June 30, 1977, 3:6795 (LA-NUREG—6934-PR)
Nuclear safeguards research and development program. Status report, January—April 1977, 3:6083 (LA—6849-PR)
Nuclear safeguards research program status report. Progress report, September—December 1976, 3:6082 (LA—6788PR)
Operating manual. Stabilized rectifier for an electromagnet, 5 volts-300 amps, 3:7198 (LA-tr—77-54)
Pacific regional solar heating handbook, 3:6282 (TID—27630)
Passive solar heating of buildings, 3:6278 (LA-UR—77-1162)
Photoionization cross sections and radiative recombination rate coefficients for positive ions of carbon and gold, 3:7732 (LA—6615)
POST: a postprocessor computer code for producing three-dimensional movies of two-phase flow in a reactor vessel, 3:6796 (LA-NUREG—6954-MS)
Proposal for the ZT-40 reversed-field Z-pinch experiment, 3:7719 (LA—6625-P)
Scattering theory and effective medium approximations to heterogeneous materials, 3:7704 (LA-UR—77-2063)
Some developments in laser isotope separation research at Los Alamos, 3:6021 (LA-UR—76-191)
Some microstructures developed in 303 stainless steel which has been shock loaded to the megabar range, 3:7081 (LA-UR—77-1875)
Some techniques for digital processing, display and interpretation of ratio images in multispectral remote sensing, 3:7789 (LA-UR—77-1877)
Thermophysical properties: some experience in research, development and applications, 3:7115 (LA-UR—77-1881)
Transient radiation effects in low loss optical waveguides, 3:7107 (LA-UR—77-1564)
Water requirements for future energy development in the West: state perspectives, 3:6878 (LA—6688-MS)
Workshop on research needs for atmospheric transport and diffusion in complex terrain, 3:7426 (CONF-7609160—)
Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. (USA). Inhalation Toxicology Research Inst.
Inhalation Toxicology Research Institute annual report, October 1, 1975—September 30, 1976, 3:7514 (LF—56)

M

Maine Univ., Orono (USA). Dept. of Electrical Engineering
Ternary compound thin film solar cells. First quarter report, September 1—December 31, 1976, 3:6190 (PB—265003)
Maryland Univ., College Park (USA). Dept. of Chemistry
Non-destructive determination of trace-element concentrations. Annual progress report, September 1977, 3:7122 (ORO—5173-001)
Maryland Univ., College Park (USA). Inst. for Physical Science and Technology
Stability of high energy focused ion beams for pellet fusion in target chamber, 3:7772 (ORO—5000-4)
Target chamber magnetic fields in pellet fusion reactors, 3:7771 (ORO—5000-3)
Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)
Cyclic recrystallization of Sandia furnished HNS I. Final report, 3:7330 (MHSMP—77-23)
Divided-flow-apparatus, 3:7314 (MHSMP—77-47)
Error analysis of mass spectrometer data. Period covered, October—December 1976, 3:7134 (MHSMP—77-5K)
FEFO degradation in LX-09. Period covered: October—December 1976, 3:7327 (MHSMP—77-5H)
Firing site objective lens mounts. Period convered: October—December 1976, 3:7312 (MHSMP—77-5I)
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Investigation of the effect of binder crystallinity on the mechanical properties of a plastic bonded explosive. Period covered: October—December 1976, 3:7329 (MHSMP—77-5L)
Light production at an explosive/air interface. Period covered: October—December 1976, 3:7328 (MHSMP—77-5J)
Mechanical sensitivity of PBX 9501. Period covered: October—December 1976, 3:7325 (MHSMP—77-5B)
Photographic instrumentation for the skid test. Period covered: October—December 1976, 3:7248 (MHSMP—77-5F)
Physical properties and sensitivity of HMX/Estane 5713 and HMX/Estane 5714. Period covered: October—December 1976, 3:7326 (MHSMP—77-5C)
Massachusetts General Hospital, Boston (USA)
New imaging systems in nuclear medicine. Technical progress report, October 1, 1976—May 31, 1977, 3:7291 (COO—3333-30)
Massachusetts Inst. of Tech., Cambridge (USA)
Fuel Coolant Thermal Interaction Project UC 79P. Quarterly progress report No. 7, 3:6786 (COO—2781-13)
Waste heat management in the electric power industry: issues of energy conservation and station operation under environmental constraints. Second quarterly progress report, December 1, 1976—March 1, 1977, 3:6522 (COO—4114-2)
Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering
Coolant mixing in the LMFBR outlet plenum, 3:6633 (COO—2245-44TR)
Mathematica, Princeton, N.J. (USA)
Industrial applications study. Volume I. Executive summary: industrial waste energy data base technology evaluation. Final report, 3:6905 (COO/2862—1)
McDonnell Douglas Astronautics Co., St. Louis, Mo. (USA)
Graphite curtain vacuum outgassing and heat transfer. Final report, 3:7779 (COO—2802-4)
Mechanical Technology, Inc., Latham, N.Y. (USA)
Design, develop, and manufacture process gas lubricated hot recycle gas circulators. Final technical report, MTI—77TR5, 3:5783 (COO—0004-1)
Miami Univ., Coral Gables, Fla. (USA). Clean Energy Research Inst.
Second Ocean Thermal Energy Conversion workshop: workshop proceedings, 3:6244 (CONF-7409169—)
Two-phase flow and heat transfer symposium-workshop. Workshop reports, 3:7240 (CONF-761039—(Summ.))
Minnesota Univ., Minneapolis (USA)
Vertebrate behavior and ecology. Progress report, July 1, 1976—June 30, 1977, 3:7466 (COO—1332-129)
Minnesota Univ., Minneapolis (USA). Dept. of Chemistry
Digital spectrometer scan controller, 3:7308 (COO—913-67)
Missouri Univ., Rolla (USA). Rock Mechanics and Explosives Research Center
Design of a water jet drill for development of geothermal resources. Annual progress report, June 1, 1976—May 31, 1977, 3:6465 (COO—2677-8)
Mobil Research and Development Corp., Paulsboro, N.J. (USA)
Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Monthly report for August 1977, 3:6113 (FE—2276-14)
Mobil Research and Development Corp., Princeton, N.J. (USA)
Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Monthly report for August 1977, 3:6113 (FE—2276-14)
Mobil Tyco Solar Energy Corp., Waltham, Mass. (USA)
Large area silicon sheet by EFG. First quarterly report, January 1, 1977—March 31, 1977, 3:6184 (ERDA/JPL/954355—77/1)
Large area silicon sheet by EFG. Second quarterly report, April 1, 1977—June 30, 1977, 3:6185 (ERDA/JPL/954355—77/2)
Mound Lab., Miamisburg, Ohio (USA)
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Volume reduction of tritiated liquid wastes with super slurper, 3:6057 (MLM—2452)

N

NAHB Research Foundation, Inc., Rockville, Md. (USA)
Infrared thermography requirements study for energy conservation, 3:7001 (CONS/2109—1)
National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center
Anion exchange membranes for electrochemical oxidation-reduction energy storage system, 3:6995 (ERDA/NASA/1002—77/2)
Potential benefits of a ceramic thermal barrier coating on large power generation gas turbines, 3:6532 (ERDA/NASA—5022/77/1)
Sensitivity of solar-cell performance to atmospheric variables. II. Dissimilar cells at several locations. Technical report II-8, 3:6188 (ERDA/NASA/1022—76/7)
National Ash Association, Washington, D.C. (USA)
Lime-fly ash-aggregate mixtures in pavement construction, 3:7047 (NP—22498)
National Bureau of Standards, Washington, D.C. (USA)
Emission and absorption x-ray edges of Li, 3:7091 (CONF-770935—1)
National Bureau of Standards, Washington, D.C. (USA). Inst. for Applied Technology
Energy conservation program guide for industry and commerce (EPIC), 3:6908 (NBS-Handbook—115)
Evaluating incentives for solar heating. Final report, 3:6280 (NBSIR—76-1127)
National Instrumentation Methods Committee (USA)
Future data bus requirements for laboratory high speed data acquisition systems, 3:7318 (TID—27621)
National Oceanic and Atmospheric Administration, Kansas City, Mo. (USA). National Severe Storms Forecast Center
Solar pilot plant, phase I. Quarterly report No. 4, July—September 1976, 3:6224 (SAN/1109—76/4)
National Oceanic and Atmospheric Administration, Washington, D.C. (USA)
International decade of ocean exploration. Progress report, Volume 6, April 1976—April 1977, 3:7617 (NP—22650)
National Science Foundation, Washington, D.C. (USA)
Second Ocean Thermal Energy Conversion workshop: workshop proceedings, 3:6244 (CONF-7409169—)
Two-phase flow and heat transfer symposium-workshop. Workshop reports, 3:7240 (CONF-761039—(Summ.))
Naval Ammunition Depot, Crane, Ind. (USA)
Evaluation program for secondary spacecraft cells: initial evaluation tests of General Electric Company 12.0 ampere-hour, nickel—cadmium spacecraft cells for the International Ultraviolet Explorer satellite, 3:6834 (N—75-10583/3ST)
Naval Research Lab., Washington, D.C. (USA)
Some Rayleigh—Taylor stabilizing mechanisms in thin laser targets, 3:7770 (NRL-MR—3574)
New Mexico Univ., Albuquerque (USA)
Radiochemistry of iodine, 3:7182 (NAS-NS—3062)
New Mexico Univ., Albuquerque (USA). Bureau of Business and Economic Research
Data base for fixed- and low-income owner-occupied housing units, 3:7027 (NMEI—76-155)

New Mexico Univ., Albuquerque (USA). Technology Application Center
Wind energy utilization: a bibliography with abstracts. Cumulative volume 1944/1974, 3:6513 (TAC-W—75-700)
New York Univ., N.Y. (USA). Div. of Applied Science
Heat transfer characteristics in a fluidized bed packed with heat exchangers, 3:7255 (NYU/DAS—77-17)
North Dakota Univ., Grand Forks (USA). Engineering Experiment Station
Project Lignite. Quarterly technical progress report No. 10, July, August, and September 1976, 3:5798 (FE—1224-68)
Project Lignite. Quarterly technical progress report No. 11, October, November, and December 1976, 3:5799 (FE—1224-72)
Northeastern Legislative Energy Staff, Albany, N.Y. (USA)
Strategic petroleum reserve plan: preliminary analysis, 3:5979 (NP—22425)
Northwestern Univ., Evanston, Ill. (USA)
Computational complexity in multidimensional neutron transport theory calculations. Progress report, September 1976—November 30, 1977, 3:7698 (COO—2280-36)
TWO-STEP, user's guide. Solution of a linear system of equations using the exact two-step method, 3:7787 (COO—2280-29)
Nuclear Regulatory Commission, Washington, D.C. (USA)
Nuclear Regulatory Commission issuances, 3:6667 (NTISUB/C/142—77/005)
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Report to Congress on abnormal occurrences, April—June 1977, 3:6670 (NUREG—0090-8)
Workshops for state review of site suitability criteria for high-level radioactive waste repositories. Discussion Group reports, 3:6065 (NUREG—0353)
Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Material Safety and Safeguards
Workshop material for state review of USNRC site suitability criteria for high-level radioactive waste repositories, 3:6064 (NUREG—0326)
Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Reactor Regulation
Health effects attributable to coal and nuclear fuel cycle alternatives, 3:7513 (NUREG—0332(Draft))
NUS Corp., Menlo Park, Calif. (USA)
Sulfur and biological systems. Summary report of a workshop at Missouri Botanical Garden, May 30—31, 1975, 3:7379 (EPRI-EA—419-SY)

O

Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)
Calculator program for the comparison of particle size distribution measurements between transmission electron microscopy and the liquid centrifuge technique, 3:6020 (K—1899)
Effect of deposition conditions on the properties of pyrolytic silicon carbide coatings for high-temperature gas-cooled reactor fuel particles, 3:6611 (ORNL/TM—5743)
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Oak Ridge National Lab., Tenn. (USA)
Advanced fuel recycle program progress report, April 1—June 30, 1977, 3:6048 (ORNL/TM—5993)
Applications of differential scanning calorimetry to the study of thermal energy storage, 3:6820 (CONF-770943—1)
Coal-fired alkali metal power system design study. Technical progress report, April 1, 1977—June 30, 1977, 3:6541 (ORNL/TM—6000)
Conference on atomic processes in high temperature plasmas: a topical conference of the American Physical Society Division of Plasma Physics, 3:7729 (CONF-770242—(Absts.))
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Oak Ridge Y-12 Plant, Tenn. (USA)
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Occidental Research Corp., La Verne, Calif. (USA)
Flash pyrolysis coal liquefaction process development. Quarterly report, October—December 1976, 3:5805 (FE—2244-8)
Flash pyrolysis coal liquefaction process development. Monthly report, May 1977, 3:5806 (FE—2244-13)

Office of Technology Assessment (U.S. Congress), Washington, D.C.
Analysis of the proposed National Energy Plan, 3:6940 (NP—22456)

Ohio State Univ., Columbus (USA)
Delays in nuclear power plant construction. Progress report, September 15, 1976—September 14, 1977, 3:6575 (COO/4121—1)

Ohio State Univ., Columbus (USA). Dept. of Radiology
Amazon Molly, Poecilia formosa, as a model for studies of the effects of ionizing radiation, 3:7507 (BNL—23239)

Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering
Catalysts for upgrading coal-derived liquids. Quarterly report, March 9—June 8, 1977, 3:5802 (FE—2011-8)

Oklahoma State Univ., Stillwater (USA). School of Electrical Engineering
Development and adaptation of field modulated generator systems for wind energy applications. Final report, 3:6520 (ERDA/NSF/AER/00647—76/2)

Oregon State Univ., Corvallis (USA)
Secondary recovery method for the extraction of geothermal energy. Annual progress report, July 1, 1975—June 30, 1976, 3:6491 (RLO—2227-T21-1)

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Pennsylvania State Univ., University Park (USA)
Geochemical dispersion of uranium near prospects in Pennsylvania, 3:6016 (GJO—1659-1)

Pennsylvania State Univ., University Park (USA). Dept. of Mineral Economics
Economic analysis of coal supply: an assessment of existing studies. Volume 2, 3:5882 (EPRI-EA—496(Vol.2))

Philadelphia Electric Co., Pa. (USA)
Peach Bottom Atomic Power Station, Units 2 and 3. Annual operating report: January—December 1976, 3:6665 (DOCKET-50277—1043)

Pittsburg and Midway Coal Mining Co., Merriam, Kans. (USA)
Solvent refined coal (SRC) process. Monthly report, August 1977, 3:5809 (FE—496-139)

Pope, Evans and Robbins, Inc., New York (USA)
Multicell fluidized-bed boiler design, construction, and test program. Quarterly progress status report, January—March 1976, 3:6535 (FE—1237-51)
Site and building energy appraisal and survey methodology study. ANL-Site energy report, 3:7041 (TID—27561)
Site and building energy appraisal and survey methodology study. ANL-Building 212 energy report, 3:7042 (TID—27562)

Pope, Evans and Robbins, Inc., New York (USA). Combustion Systems Div.
Multicell fluidized bed boiler design, construction, and test program: fluidized bed boiler cold modeling. Final report, 3:6534 (FE—1237-43)
Multicell fluidized-bed boiler design, construction and test program. Interim report, July 1974—June 1975, 3:6533 (FE—1237-38)
Multicell fluidized-bed boiler design, construction and test program. Quarterly progress status report, October—December 1976, 3:6536 (FE—1237-63)
Multicell fluidized-bed boiler design, construction, and test program. Quarterly progress status report, January—March 1977, 3:6537 (FE—1237-67)

Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)
Progress report on fast breeder reactor development in Japan, October—December 1976, 3:6664 (JAPFNR—260)

Princeton Univ., N.J. (USA). Plasma Physics Lab.
Critical impurity concentrations for ignition of catalyzed-deuterium fusion plasmas, 3:7765 (PPPL—1368)
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Deexcitation processes in nuclear reactions. Progress report, May 1, 1976—July 31, 1977, 3:7687 (COO—1505-86)
Purdue Univ., Lafayette, Ind. (USA). Dept. of Physics
Inclusive charged pion production in π^{+-} p interactions, 3:7649 (COO—1428-443)
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Purdue Univ., Lafayette, Ind. (USA). School of Nuclear Engineering
Impact of delays in plutonium use on the stationary growth rate of fast breeder reactor fuel, 3:6637 (COO/4116—1)
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Radian Corp., Austin, Tex. (USA)
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RCA Advanced Technology Labs., Camden, N.J. (USA)
Technical and economic feasibility of thermal storage. Final report, 3:6352 (COO/2591—76/1)
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SDG and E/ERDA geothermal loop experimental facility. Bi-monthly report, January—February 1977, 3:6453 (SAN/1137—5)
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Research Consulting Associates, Lexington, Mass. (USA)
Dynamic load model study for overhead transmission lines. Final report, November 1975—September 1976, 3:6569 (CONS/2063—1)
RE;SPEC, Inc., Rapid City, S.Dak. (USA)
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Sandia Labs., Livermore, Calif. (USA)
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Formation of protective layers on alloys in coal processing environments. Annual report, February 1, 1976—March 31, 1977, 3:5796 (SAND—77-8260)

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Science Applications, Inc., Albuquerque, N.Mex. (USA)
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Science Applications, Inc., La Jolla, Calif. (USA)
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Solar, San Diego, Calif. (USA)
Development of a ceramic tube heat exchanger with relaxing joint. Monthly technical progress report, May 1—June 1, 1977, 3:6538 (FE—2556-05)
Development of a ceramic tube heat exchanger with relaxing joint. Monthly technical progress report, August 1—September 1, 1977, 3:6539 (FE—2556-08)

South Carolina Univ., Columbia (USA). Coll. of Engineering
Web-dendritic ribbon growth. USC solar report No. Q-6. Quarterly report, April 1, 1977—June 30, 1977, 3:6182 (ERDA/JPL/954344—77/2)

Southern Co. Services, Inc., Birmingham, Ala. (USA)
Full-sclae utility boiler test with solvent refined coal (SRC). Technical progress report, June 1977, 3:5880 (FE—2222-7)

Springborn Labs., Inc., Enfield, Conn. (USA)
Investigation of test methods, material properties, and processes for solar cell encapsulants. Annual report, 3:6187 (ERDA/JPL/954527—77/2)

SRI International, Menlo Park, Calif. (USA)
Homogeneous catalytic hydrocracking processes for conversion of coal to liquid fuels: basic and exploratory research. Quarterly report No. 6, February 1, 1977—April 30, 1977, 3:5804 (FE—2202-18)

Stanford Linear Accelerator Center, Calif. (USA)
Some engineering objections to using reinforcing steel as grounding electrodes, 3:7250 (SLAC-PUB—822)

Stanford Research Inst., Menlo Park, Calif. (USA)
Research studies on short optical pulse generation for the laser fusion program. Final report, 11 January 1976—11 March 1977, 3:7207 (UCRL—13746)

Stanford Univ., Calif. (USA)
Energy conservation: a vehicle for change, 3:6910 (NP—22485)

Stanford Univ., Calif. (USA). Inst. for Plasma Research
Computer simulation experiments on electrostatic—inertial confinement. Final report, 3:7715 (AD—716860)

Stanley Consultants, Washington, D.C. (USA)
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State Univ. of New York, Stony Brook (USA)
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Stone and Webster Engineering Corp., Boston, Mass. (USA)
Plant systems/components modularization study. Final report, 3:6590 (COO—4039-1)
Tidal power study for the United States Energy Research and Development Administration. Final report. Volume 1, 3:6509 (DGE/2293—3(Vol.1))
Tidal power study for the United States Energy Research and Development Administration. Final report. Volume 2, 3:6510 (DGE/2293—3(Vol.2))

Systems Control, Inc., Palo Alto, Calif. (USA)
Impact of load management strategies upon electric utility costs and fuel consumption, 3:7002 (FEA/D—77/208)

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Tata Inst. of Fundamental Research, Bombay (India)
Radiochemistry of bismuth, 3:7181 (NAS-NS—3061)

Technische Hochschule Darmstadt (Germany, F.R.)
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Technische Univ. Berlin (Germany, F.R.)
Contribution to the calculation of a cylindrically symmetric inductive MHD generator with special consideration to finite length, 3:6986 (NP—22622)

Temple Univ., Philadelphia, Pa. (USA). Dept. of Chemistry
Improved semiconductors for photovoltaic solar cells. Quarterly report No. 2, October 1—December 31, 1976, 3:6180 (DSE/2457—2)

Temple Univ., Philadelphia, Pa. (USA). Dept. of Physics
Experimental investigations in particle physics at intermediate energies. Progress report, December 1, 1976—November 30, 1977, 3:7633 (COO—3539-8)

Tennessee Technological Univ., Cookeville (USA)
Thermal conductivity, electrical resistivity and Seebeck coefficient of high purity iron and selected iron alloys from 90 K to 400 K, 3:7093 (TID—27707)

Tennessee Univ., Knoxville (USA). Appalachian Resources Project
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Tennessee Univ., Knoxville (USA). Dept. of Physics
Theory of waves, instabilities, and transport in thermonuclear plasmas. Progress report, 1 June 1976—1 December 1977, 3:7734 (ORO—2598-10)

Texas Agricultural and Mechanical Univ., College Station (USA). Research Foundation
Study of the neutron—proton interaction in the 300—700 MeV energy region. Annual progress report, 1976—1977, 3:7647 (ORO—4449-22)

Texas Univ., Austin (USA)
International developments in controlled thermonuclear fusion, 3:7728 (AD—650036)

Texas Univ., Austin (USA). Center for Particle Theory
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Thermo Electron Corp., Waltham, Mass. (USA)
ERDA/NASA advanced thermionic technology program. Progress report No. 23, 3:6989 (COO—3056-25)

Tosco Corp., Los Angeles, Calif. (USA)
Statement to the Committee on Energy and Natural Resources, Subcommittee on Energy Research and Water Resources, United States Senate, 3:5996 (NP—22413)

Transport and Road Research Lab., Crowthorne (UK)
Review of market prospects for battery electric road vehicles. 2, 3:7063 (LR—631)

TRW Systems and Energy Group, Redondo Beach, Calif. (USA)
Utilization of U.S. geothermal resources. Final report, 3:6364 (EPRI-ER—382)

U

Union Carbide Corp., Oak Ridge, Tenn. (USA). Office of Waste Isolation
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Union Carbide Corp., Parma, Ohio (USA). Carbon Products Div.
Low cost silicon solar array project. Establishment of the feasibility of a process capable of low cost, high volume production of silane (Phase I), and the pyrolysis of silane to semiconductor-grade silicon (Phase II). Quarterly progress report, January—March 1977, 3:6181 (ERDA/JPL/954334—77/2)

Union Carbide Corp., Sistersville, W.Va. (USA)
Low cost silicon solar array project. Establishment of the feasibility of a process capable of low cost, high volume

production of silane (Phase I), and the pyrolysis of silane to semiconductor-grade silicon (Phase II). Quarterly progress report, January—March 1977, 3:6181 (ERDA/JPL/954334—77/2)

United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)
Capital cost: pressurized water reactor plant. Commerical electric power cost studies, 3:6588 (COO—2477-5(Vol.1))
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United Nations, Geneva (Switzerland). Economic Commission for Europe
Increased energy economy and efficiency in the ECE region. Study on measures taken, or which might be taken, to achieve increased economy and efficiency in the extraction, conversion, transport and use of energy in the ECE region, 3:6998 (E/ECE—883(Rev.1))

United Technologies Research Center, East Hartford, Conn. (USA)
Industrial applications study. Volume I. Executive summary: industrial waste energy data base technology evaluation. Final report, 3:6905 (COO/2862—1)

University of Southern California, Los Angeles (USA)
Chemistry and structure of coal-derived asphaltenes, Phase I. Quarterly progress report, July—September 1975, 3:5811 (FE—2031-1)
Chemistry and structure of coal-derived asphaltenes, Phase I. Quarterly progress report, October—December 1975, 3:5812 (FE—2031-2)
Chemistry and structure of coal-derived asphaltenes, Phase I. Quarterly progress report, January—March 1976, 3:5803 (FE—2031-3)

Utah Engineering Experiment Station, Salt Lake City (USA)
Home energy saver's program: a report on a demonstration project undertaken in Utah, 3:6911 (TID—22791)

Utah Office of the State Planning Coordinator, Salt Lake City (USA)
Utah Process alternative futures, 1975—1990. Introduction and summary, 3:6859 (NP—22465(Summ.))
Utah process alternative futures, 1975—1990. Volume I: assumptions and projections, 3:6857 (NP—22465/1)
Utah Process alternative futures, 1975—1990. Volume II. Detailed projections, 3:6858 (NP—22465/2)

Utah State Univ., Logan (USA). Dept. of Biology
Energy transfer mechanisms in photobiological reactions. Progress report, 1 August 1976—31 July 1977, 3:7469 (COO—875-178)

Utah Univ., Salt Lake City (USA). Dept. of Biology
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Oil persistence in tundra and its impact on the belowground ecosystem. Progress report, June 1, 1976—March 1, 1977, 3:7429 (ORO/4940—2)

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Wayne State Univ., Detroit, Mich. (USA). Dept. of Chemistry
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Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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9	3:5782	Dep. NTIS, PC A03/MF A01
CONF-770653-	(International conference on multiphoton processes, Rochester, New York, United States of America (USA), 6-9 Jun 1977)	
1	3:7628	*See* UCRL-79470
(Absts.)	3:7627	Dep. NTIS, PC A12/MF A01
CONF-770662-	(International colloquium on refractory oxides for high temperature energy sources, Odeillo, France, 28 Jun-1 Jul 1977)	
3	3:7179	Dep. NTIS, PC A02;MF A01
CONF-770674-	(Nucleon-nucleon interaction meeting, Vancouver, Canada, 27-30 Jun 1977)	
4	3:7643	*See* ANL-HEP-PR-CP-77-47
6	3:7646	*See* LA-UR-77-1938
7	3:7642	*See* ANL-HEP-CP-77-57
CONF-770685-	(5. international conference on information processing in medical imaging, Nashville, Tennessee, USA, 27 Jun-1 Jul 1977)	
2	3:7290	Dep. NTIS, PC A02/MF A01
CONF-770692-	(International conference on stochastic behavior and quantum hamiltonian systems, Tremezzo, Italy, 20-24 Jun 1977)	
1	3:7711	*See* UCRL-80121
CONF-770697-	(8. international symposium on multi-particle dynamics, Kaysersberg, France, 12-19 Jun 1977)	
1	3:7649	*See* COO-1428-443
CONF-770698-	(Conference on boron in glass and glass ceramics, Alfred, New York, USA, 5-8 Jun 1977)	
1	3:7114	*See* UCRL-79530
CONF-770706-	(6. AIRAPT international high-pressure conference, Boulder, Colorado, United States of America (USA), 25-29 Jul 1977)	
29	3:5988	*See* UCRL-79021
30	3:7196	*See* UCRL-79591
CONF-770709-	(10. international conference on high energy accelerators, Serpukhov, Union of Soviet Socialist Republics (USSR), 11-17 Jul 1977)	
1	3:7265	Dep. NTIS, PC A02/MF A01
3	3:7289	*See* LBL-6459
5	3:7266	Dep. NTIS, PC A02/MF A01
7	3:7284	*See* BNL-22927
8	3:7285	*See* BNL-22930
9	3:7267	Dep. NTIS, PC A02/MF A01
10	3:7274	Dep. NTIS, PC A02/MF A01
12	3:7275	Dep. NTIS, PC A02/MF A01
13	3:7279	*See* LA-UR-77-1545
14	3:7270	*See* LBL-6425
CONF-770714-	(IEEE conference on nuclear and space radiation effects, Williamsburg, Virginia, United States of America (USA), 12-15 Jul 1977)	
5	3:7107	*See* LA-UR-77-1564
6	3:7304	*See* SAND-76-5554C
CONF-770715-	(2. public meeting to review the status of the inexhaustible energy resources study, Washington, District of Columbia, United States of America (USA), 20 Jul 1977)	
	3:6979	Dep. NTIS, PC A04/MF A01
CONF-770725-	(11. international symposium on shock tubes and waves, Seattle, Washington, USA, 11-14 Jul 1977)	
2	3:7778	*See* COO-2456-47
CONF-770727-	(Workshop on energy resources conservation, Sacramento, California, USA, 14 Jul 1977)	
1	3:6211	*See* UCRL-79716
CONF-770732-	(International conference on solar building technology, London, UK, 25-29 Jul 1977)	
1	3:6279	*See* LA-UR-77-1555
CONF-770738-	(Workshop on rapid solidification, La Jolla, California, USA, 11-13 Jul 1977)	
1	3:7081	*See* LA-UR-77-1875
CONF-770803-	(6. international colloquium on gasdynamics of explosions and reactive systems, Stockholm, Sweden, 22-26 Aug 1977)	
3	3:7331	*See* UCRL-79117
CONF-770804-	(12. intersociety energy conversion engineering conference, Washington, District of Columbia, United States of America (USA), 28 Aug-2 Sep 1977)	
11	3:7026	Dep. NTIS, PC A02/MF A01
12	3:7000	Dep. NTIS, PC A02/MF A01
CONF-770807-	(4. international conference on structural mechanics in reactor technology, San Francisco, California, United States of America (USA), 15-19 Aug 1977)	
37	3:6629	Dep. NTIS, PC A02/MF A01
41	3:6630	Dep. NTIS, PC A02/MF A01
CONF-770814-	(American Chemical Society meeting, Chicago, Illinois, United States of America (USA), 29 Aug-2 Sep 1977)	
7	3:7142	*See* BNL-23217
CONF-770822-	(American Nuclear Society meeting, Chattanooga, Tennessee, USA, 8-10 Aug 1977)	
5	3:6631	Dep. NTIS, PC A02/MF A01
CONF-770823-	(International symposium on hydrides for energy storage, Geilo, Norway, 14-19 Aug 1977)	
3	3:6109	*See* BNL-23047
CONF-770827-	(International conference on physics of transition metals, Toronto, Canada, 15-18 Aug 1977)	
6	3:7089	*See* BNL-23135

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CONF-770830-		(20. congress of the International Society of Limnology, Copenhagen, Denmark, 7-14 Aug 1977)
3	3:7443	Dep. NTIS, PC A02/MF A01
CONF-770832-		(2. national symposium on diseases of white-tailed deer, Athens, Georgia, USA, 8-9 Aug 1977)
1	3:7494	Dep. NTIS, PC A02/MF A01
CONF-770840-		(9. international seaweed symposium, Santa Barbara, California, USA, 20-27 Aug 1977)
1	3:6210	*See* UCRL-79299
CONF-770842-		(6. international conference on magnet technology, Bratislava, Czechoslovakia, 29 Aug-2 Sep 1977)
2	3:7286	*See* BNL-23142
3	3:7277	*See* LA-UR-77-1789
6	3:7758	Dep. NTIS, PC A02/MF A01
11	3:7276	*See* BNL-23211
CONF-770843-		(International thermal expansion symposium, Winnipeg, Canada, 29-31 Aug 1977)
2	3:7115	*See* LA-UR-77-1881
3	3:7095	*See* UCRL-80007
CONF-770844-		(International optical computing conference, San Diego, California, USA, 25-26 Aug 1977)
1	3:7789	*See* LA-UR-77-1877
5	3:7775	*See* UCRL-80004
CONF-770851-		(International symposium on quantum chemistry, Uppsala, Sweden, 31 Aug-Sep 1977)
1	3:7332	*See* UCRL-79612
CONF-770854-		(Conference on modeling and simulation of land, air and water resources systems, Ghent, Belgium, 30 Aug-2 Sep 1977)
1	3:6447	*See* UCRL-79977
CONF-770855-		(5. international conference on high voltage electron microscopy, Kyoto, Japan, 29 Aug-1 Sep 1977)
1	3:7099	NTIS, MF A01
2	3:7307	Dep. NTIS, PC A02/MF A01
CONF-770868-		(21. annual technical symposium of the Society of Photo-Optical Instrumentation, San Diego, California, USA, 22-26 Aug 1977)
1	3:7769	*See* LA-UR-77-1923
CONF-770906-		(8. European conference on controlled fusion and plasma physics, Prague, Czechoslovakia, 19-23 Sep 1977)
4	3:7716	Dep. NTIS, PC A02/MF A01
CONF-770907-		(International solvent extraction conference, Toronto, Canada, 9-16 Sep 1977)
1	3:7253	*See* SAND-76-9149C
CONF-770920-		(JOWOG-28 conference, Aldermaston, Reading, UK, 20-22 Sep 1977)
1	3:7166	*See* SAND-77-1267C
2	3:7111	*See* SAND-76-5225C
CONF-770925-		(Electrical transport and optical properties of inhomogeneous media conference, Columbus, Ohio, USA, 7-9 Sep 1977)
2	3:7704	*See* LA-UR-77-2063
CONF-770927-		(Symposium on macroscopic features of heavy-ion collisions and pre-equilibrium processes, Hakone, Japan, 2-3 Sep 1977)
2	3:7693	*See* LBL-6587
CONF-770929-		(Seminar on HTGR safety technology, Upton, New York, USA, 15-16 Sep 1977)
11	3:6599	*See* BNL-NUREG-23228
CONF-770932-		(ORSA symposium, San Diego, California, USA, 23 Sep 1977)
1	3:7786	*See* UCRL-79595
CONF-770933-		(International Atomic Energy Agency, international working group on fast reactors, Argonne, Illinois, USA, 20-23 Sep 1977)
1	3:6632	Dep. NTIS, PC A04/MF A01
CONF-770935-		(5. international conference on vacuum ultraviolet radiation physics, Montpellier, France, 5-9 Sep 1977)
1	3:7091	Dep. NTIS, PC A02/MF A01
3	3:7624	*See* LBL-6900
CONF-770937-		(ERDA/AESOP 17, Boston, Massachusetts, USA, 13-15 Sep 1977)
1	3:7795	*See* UCRL-80053
CONF-770940-		(Symposium on the production and neutralization of negative hydrogen ions and beams, Upton, New York, USA, 26-30 Sep 1977)
1	3:7626	*See* UCRL-79927
2	3:7767	*See* UCRL-79570
7	3:7629	*See* LBL-6838
8	3:7623	*See* LBL-6839
9	3:7622	*See* LBL-6837
CONF-770943-		(7. Thermal Analysis Society conference, St. Louis, Missouri, USA, 26-28 Sep 1977)
1	3:6820	Dep. NTIS, PC A02/MF A01
2	3:5822	Dep. NTIS, PC A02/MF A01
CONF-770944-		(Solar energy workshop, Ashkhabad, USSR, Sep 1977)
1	3:6239	*See* SAND-77-8510
CONF-770949-		(International conference on low energy ion beams, Salford, UK, 5-8 Sep 1977)
1	3:7625	*See* UCRL-79311
CONF-770953-		(Concentrating solar collector conference, Atlanta, Georgia, USA, 26-28 Sep 1977)
3	3:6327	*See* SAND-77-1461C
CONF-770954-		(2. conference on hot plasma diagnostics, Kharkov, USSR, 22-27 Sep 1977)
1	3:7726	*See* UCRL-80058(Rev.1)
CONF-770955-		(ERDA-information exchange meeting for thermal energy storage program, Gatlinburg, Tennessee, USA, 29-30 Sep 1977)
1	3:6821	*See* UCRL-80115
CONF-770956-		(Energy workshop of the National Science Council of Ireland, Dublin, Ireland, 13 Sep 1977)
1	3:6975	*See* BNL-23193
CONF-770962-		(6. international conference on the use of computers in radiation therapy, Goettingen, F.R. Germany, 18-23 Sep 1977)
1	3:7504	*See* LA-UR-77-2053
CONF-770976-		(Conference on precise electrical measurement, Brighton, UK, 5-9 Sep 1977)
1	3:7310	*See* LBL-6498
CONF-771015-		(Fall meeting of the Western States Section of the Combustion Institute, Palo Alto, California, USA, 17-18 Oct 1977)
1	3:7187	*See* SAND-77-1115C
2	3:7255	*See* NYU/DAS-77-17
CONF-771022-		(9. national SAMPE technical conference, Atlanta, Georgia, USA, 4-6 Oct 1977)
1	3:7316	*See* SAND-77-1122C
CONF-771027-		(American Society of Civil Engineers annual convention, San Francisco, California, USA, 17-21 Oct 1977)
1	3:7195	*See* UCRL-78765
CONF-771028-		(Conference on electrical insulation and dielectric phenomena, Schenectady, New York, USA, 17-20 Oct 1977)
1	3:6565	*See* SAND-77-0809C
2	3:6564	*See* SAND-77-0799C
CONF-771031-		(21. conference on analytical chemistry in energy technology, Gatlinburg, Tennessee, USA, 4-6 Oct 1977)
3	3:6084	*See* LA-UR-2247
7	3:7697	Dep. NTIS, PC A02/MF A01
CONF-771032-		(EPRI seminar: exploring applications of digital parallel processing to power systems analysis problems, Palo Alto, California, USA, 4-7 Oct 1977)
1	3:7794	*See* UCRL-80025
CONF-771035-		(2. international topical conference, Ithaca, New York, USA, 3-5 Oct 1977)
1	3:7773	*See* SAND-77-2017C
CONF-771036-		(2. ASTM-EURATOM symposium on reactor dosimetry: dosimetry methods for fuels, cladding and structural materials, Palo Alto, California, USA, 2-7 Oct 1977)
2	3:7294	Dep. NTIS, PC A02/MF A01
CONF-771038-		(Eastern gas shale program conference, Morgantown, West Virginia, USA, 17-19 Oct 1977)
1	3:5986	*See* LA-UR-77-2066
2	3:5987	*See* SAND-77-1020C
CONF-771039-		(13. rare earth research conference, Olgebay Park, West Virginia, USA, 16-20 Oct 1977)
1	3:6101	*See* LA-UR-77-2030
CONF-771040-		(Electro-Optical systems conference, Anaheim, California, USA, 25-27 Oct 1977)
2	3:7320	*See* UCRL-80129
CONF-771044-		(EMP environments and protection implementation seminar, Eglin Air Force Base, Florida, USA, 4-6 Oct 1977)
1	3:7305	*See* SAND-77-1500C

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CONF-771046-		(Conference of the Association of Game and Fish Commissioners, San Antonio, Texas, USA, 12-14 Oct 1977)
1	3:7462	Dep. NTIS, PC A02/MF A01
CONF-771047-		(2. international kimberlite conference, Santa Fe, New Mexico, USA, 3-7 Oct 1977)
1	3:7611	*See* UCRL-79948
CONF-771049-		(48. shock and vibration symposium, Huntsville, Georgia, USA, 19 Oct 1977)
1	3:7303	*See* SAND-77-1568C
CONF-771050-		(4. JTCG aircraft/stores compatibility symposium, Ft. Walton, Florida, USA, 12-14 Oct 1977)
2	3:7192	*See* SAND-77-8633A
CONF-771053-		(Flywheel technology symposium, San Francisco, California, USA, 5-7 Oct 1977)
1	3:6818	*See* SAND-0985C
2	3:6819	*See* UCRL-79503
CONF-771102-		(20. annual AICHE meeting, New York, New York, USA, 13-17 Nov 1977)
5	3:7108	*See* BNL-22640
CONF-771103-		(5. conference on probability and statistics in atmospheric sciences, Las Vegas, Nevada, USA, 15-18 Nov 1977)
1	3:7336	*See* BNL-23146
CONF-771105-		(14. annual meeting of the Society of Engineering Science, Bethlehem, Pennsylvania, USA, 14-16 Nov 1977)
1	3:7204	*See* SAND-77-0523C
CONF-771107-		(6. annual symposium on operating systems principles, West Lafayette, Indiana, USA, 16-18 Nov 1977)
1	3:7788	*See* LA-UR-77-893
CONF-771109-		(ANS winter meeting, San Francisco, California, USA, 27 Nov-2 Dec 1977)
4	3:6804	*See* SAND-77-1094C
6	3:6805	*See* SAND-77-1117C
12	3:6803	*See* SAND-77-1018C
20	3:6090	*See* SAND-77-1040C
CONF-771110-		(24. national vacuum symposium of the American Vacuum Society, Boston, Massachusetts, USA, 8-11 Nov 1977)
2	3:7090	*See* BNL-23236
3	3:7251	*See* BNL-23195
CONF-771112-		(29. annual southeastern regional meeting of the American Chemical Society, Tampa, Florida, USA, 9-11 Nov 1977)
1	3:7133	*See* DPSPU-77-30-7
CONF-771115-		(Advisory group on methodology of radiation effects experiments on aquatic organisms and ecosystems for evaluation, Vienna, Austria, 21-25 Nov 1977)
1	3:7507	*See* BNL-23239
CONF-771120-		(Winter annual meeting of the American Society of Mechanical Engineers, Atlanta, Georgia, USA, 27 Nov-2 Dec 1977)
9	3:6324	Dep. NTIS, PC A02/MF A01
CONF-771201-		(IEEE international electron devices meeting, Washington, District of Columbia, USA, 5-7 Dec 1977)
3	3:7315	*See* SAND-77-0936C
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1	3:6846	*See* BNL-23087
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22631/16/4	3:6045	California Energy Resource Conservation and Development Commission, Sacramento, CA
22638/1	3:6948	Energy Resources Conservation and Development Commission (1977).
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22638/4	3:6953	Energy Resources Conservation and Development Commission (1977).
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22638/6	3:6894	Energy Resources Conservation and Development Commission (1977).
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